



House of Commons
Environment, Food and Rural
Affairs Committee

**Badgers and cattle TB:
the final report of the
Independent Scientific
Group on Cattle TB**

Fourth Report of Session 2007–08

Volume II

Oral and written evidence

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Environment, Food and Rural Affairs Committee

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Oral evidence

Taken before the Environment, Food and Rural Affairs Committee

on Monday 18 June 2007

Members present:

Mr Michael Jack, in the Chair

Mr Geoffrey Cox
Mr David Drew
Mr James Gray
Dan Rogerson

Sir Peter Soulsby
David Taylor
Mr Roger Williams

Witnesses: **Professor John Bourne CBE**, Chairman, **Professor Christl Donnelly**, Deputy Chairman, **Professor John McInerney OBE**, Member, and **Professor Rosie Woodroffe**, Member, Independent Scientific Group on Cattle TB, gave evidence.

Q1 Chairman: Ladies and gentlemen, in the words of a famous and old radio programme, if everybody is sitting comfortably, then we will begin. There is a sense of *déjà vu* amongst quite a lot of us around this table that once again we are discussing territory with which we have become familiar over the last few years in dealing with policy matters connected with the control and eradication of bovine TB. Here we are once again with the final report of the Independent Scientific Group on Cattle TB before us. Can I for the last time, perhaps with a tinge of sadness, welcome Professor John Bourne, the group's Chairman, supported today by Professor Christl Donnelly, the Deputy Chairman, Professor John McInerney, who is a member of the group, and also Professor Rosie Woodroffe. You have been before the Committee before, for which we are grateful. We have had a chance to look briefly at your final work of scholarship on this particular subject and we are very grateful to you, at relatively short notice and in fact on the very day when your findings became public, for coming to join us. Without doubt, you have given a real boost to *Farming Today*. Those of you who were up on Saturday morning would have heard *Farming Today* this week with the run-in to this, and indeed, this morning you could not have got away from it; Professor, you were on the radio at an early hour. So we were well armed with your views before we even got into the House of Commons. Nonetheless, we are genuinely grateful to you for coming and being before us today. One of the things that we are just trying to work out in terms of the modalities, Professor Bourne, is what Defra are actually now going to do with this information, because we understand that, in terms of your principal findings, they managed to get hold of them a little ahead of the public, which is perfectly understandable and no criticism is implied. When you presented your findings to Defra, did they give you any indication as to how long they were going to take to digest what you had put before them and try and give some indication to the concerns in the farming and wildlife areas as to what on earth they were going to do now?

Professor Bourne: These findings are not new; they are not new to Defra. If I take you back to September 2005, when we were asked by Mr

Bradshaw to pull down early, prematurely, trial data to inform his Autumn Statement, we did that. We advised him that we did not wish to do that but we did, and we presented at that time evidence of a positive proactive culling effect and evidence of a negative edge effect. We did extrapolate that on the basis of models because it was suggested we did to see what would happen if one culled over a larger area. We did state at that time that while theoretically that was possible, pragmatically it would be extremely difficult to achieve, but it would require far more analysis and data and a cost benefit consideration before it could even be considered as a policy option. We followed that with a statement in January 2006, of course, which related to the consultation document. You will recall there were three proposals for culling and we were surprised to see two of them highlighted which clearly the scientific evidence negated, and I was forced, as you know, to write to the Minister at that time and again express our guarded views about culling over large areas. We extended those discussions with Defra, and I have a record of discussions on 22 March 2006 with Defra, where we advised them very clearly that future policy should have a cattle-based focus and that culling would make matters worse. As we extended our analyses, I met with the Minister, Mr Bradshaw, on 24 April, repeating those comments at a discussion with him that localised culling was ineffective, and proactive culling extended to 300 square kilometres was likely to make matters worse in the way the Government perceived it would be done. I met Mr Bradshaw again on 29 November 2006 and presented more detailed analyses, because by this time we were able to analyse the full 50 plus triplet years of the trial where we had hardened up on our data, closer confidence intervals, and made it clear to him that culling would make things worse and one should focus on a cattle control policy. I repeated that with Mr Miliband on 1 February. In the interim, of course, we had weekly discussions—probably more frequently than that—and certainly our monthly meeting with Defra officials, so they clearly knew where we were coming from. All the scientific publications that left the ISG went through

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Defra's hands. Copies were rested with Ministers long before they were in the press. Defra colleagues were asked to advise on those publications and their advice was always taken; it was extremely useful. Ministers received a copy of all those publications pre-publication. So it is not only in the last few weeks that they have appreciated what the developments have been with our work but they did see fairly forward not a complete draft report on I think it was May 23 of this year. It has been an ongoing process of reiteration and communication during that period.

Q2 Chairman: In terms of this piece of work, is it, if you like, the ultimate review of all the information that you have? The message I am getting is that really not a lot has changed since we last discussed your findings. In other words, you have had a chance to look back over, as you were saying, all of the data now from the randomised trials. You have looked at that but then you had looked at them before. The conclusion that you have come to, which is effectively that large-scale culling really does not have a part to play, is entirely consistent with everything you have said, so it is almost as if you have peer-reviewed your own research and come back to the same conclusions as before. Is that a fair summary of where you are?

Professor Bourne: We constantly evaluate our research but we do so in discussion with Defra. As you know, it has been our policy to work to strict scientific practice and good guidelines—we can talk about that later—which involves publication of our work in peer-reviewed journals, and we have purposely gone for high-quality journals. We have publications in those journals, internationally peer-reviewed. In addition to that, of course, we have had our work audited independently by auditors appointed not by us but by Defra. The final audit report from the statistical auditor came in today and I believe you have copies of that. I think he makes some very pertinent conclusions as far as the thoroughness of the work we have done and does indeed make recommendations for how science should be developed and translated into policy for the future.

Q3 Chairman: Do you know if Professor Godfray, who has himself done work, I seem to recall, in 2003, when Defra established an independent scientific review, notwithstanding all that you have said in terms of putting this material into high-quality scientific journals, are you aware that Defra are planning to do that in terms of the latest publication?

Professor Bourne: I am not aware of that. It has been mooted but I am not really aware.

Q4 Chairman: From a scientific point of view, would you be distressed if such an exercise were required?

Professor Bourne: From a scientific point of view, given the rigidity of the audits we have gone through and the peer review, I would have thought it was unnecessary, but if Defra want to do it, good luck to them.

Q5 Chairman: That answers that question. You mentioned that Defra have had sight of this since 23 May and were aware before that of the work that you were doing. The name of your group is the Independent Scientific Group. Can you tell the Committee if at any time you came under any kind of pressure from either Defra or its Ministers and or both that might have been deemed to be a way of influencing the direction of travel of the work that you were undertaking?

Professor Bourne: No. If one goes back to the outset, of course, we had great trouble in getting much of the work in place but I think we fought our corner pretty well and retained our independence. It is very interesting. You mentioned the Godfray Report, and one of the recommendations of the Godfray Report was that we should lose our independence, that we should report not to Ministers but to the Chief Scientific Adviser. He made other recommendations too which have subsequently been shown to be wrong. Fortunately, the Minister did not respond to those recommendations. I do not think in fact Defra ever responded to his report.

Q6 Chairman: Could you just say that again, Professor Bourne, because Mr Cox missed the point.

Professor Bourne: Professor Godfray in his report suggested that we did lose our independence—I am not sure he even realised what he was doing—by suggesting that we reported not directly to Ministers but indirectly to Ministers through the Chief Scientific Adviser. I also said that Godfray made other recommendations—he made two, in point of fact. One was that he suggested that 50 triplet years was inadequate for the power of the experiment and we might have to extend that by several more years, and that has been proven to be wrong. He also suggested that data should be released prematurely to Defra at that time but fortunately Ministers rejected that. I think you know how strongly we reacted to that suggestion. It would have completely undermined the trials.

Q7 Mr Williams: When you say that Professor Godfray's conclusion that there were not enough triplet years has been proved to be wrong, is that because of the statistical analysis of the work that has been done or is that some independent review of his conclusions?

Professor Donnelly: At the time we did alternative calculations and we believed that we were on track to get the level of precision that we needed in 50 triplet years, but the real proof of the pudding is yes, once you have the data, calculating confidence intervals, and the fact that we have been able to estimate the impact of proactive culling plus or minus 10%.

Professor Woodroffe: Professor Godfray and members of his group have gone out of their way to express their conviction that our results are correct.

Professor Bourne: We have had pleasant exchanges with Professor Godfray.

Professor Woodroffe: One of them last time we were here. He was with us.

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Q8 Chairman: Before we get into the detail of your work, a fact which just caught my eye re-reading some of the material behind what you have been doing, if we go back to 1986, there were at that time 638 cattle that were compulsorily slaughtered because they had TB. We come to 2004 and the figure had risen by that time to about 22,500. It just occurred to me, I suppose, because TB has become such an accepted part of life in certain parts of the country as to why the massive increase? Why from 1986, at a relatively low level incidence, has TB suddenly gone on the upward march? Can you refresh my memory as to why that occurred?

Professor Bourne: As a result of the work we have done, we believe there are two factors contributing to this. One is the contribution that badgers make—there is no dispute about the fact that badgers do contribute to the cattle disease—and the other is the contribution the cattle themselves make to the disease, which subsequent work has shown to be related to the limitations of the tuberculin test, the fact that so many infected, undetected animals remain in the national herd and these animals are simply being moved around.

Q9 Chairman: What I was getting at was that, at a relatively low level, there would not obviously be the same degree of public attention as there is now because what we have seen is suddenly from, being almost unnoticeable—600 is not unnoticeable but very low levels of disease—

Professor Bourne: There is a doubling every four and half years.

Q10 Chairman: I was just intrigued to know why all of a sudden, 1986-87 double, did it start to multiply up over that period? What was the epidemiology of this sudden explosion of this particular disease, which I presume had been chugging along at a low level?

Professor Bourne: It had been increasing since the late Seventies.

Q11 Chairman: But what was driving that?

Professor Bourne: Those two aspects that I talked about, the contribution that badgers make and the contribution that cattle themselves make. We had no idea at that time what the badger contribution was and we cannot be absolutely precise about that now. Modelling suggests that it might be 30% or no less but that modelling is imprecise and it does not take into account perturbation, but it does indicate that the cattle contribution is very, very large. We do know, of course, in parts of the country the contribution from cattle is almost solely responsible for the development of the disease and the long-distance geographical transmission of the disease.

Q12 Mr Williams: The tuberculin test very much in the same form as was being used at the time the Chairman is talking about was a tool that was used to almost eliminate TB from the national herd.

Professor Bourne: That is very true. They were very subtle changes, of course, in the way that test was used over the period from 1960 to 2006, certainly into the 1990s. It was developed as a herd test. The obvious way to use a herd test is, if you find an infected herd, to take it out. There are, unfortunately, no historical figures about the number of herds that were actually slaughtered in the 1960s, just the number of cattle, and I think if you go back and see how many cattle were slaughtered in the 1960s, it makes the 22,000 we have now pale into insignificance. It was up around the 40,000-50,000 mark per year. Herds then were very small, very much smaller. As the disease eradication programme progressed, cattle testing regimes in fact were eased, and they were further eased—I am not sure of the timing of this; it could have been the late Eighties or into the Nineties—moving from one-year to two-year to three-year to four-year testing. One does not know the direct answer to your question but I suspect the rigidity of cattle testing was relaxed. The movement control which we saw in the Sixties with the tested herds, the TB-free herds—you were not allowed to buy an animal from TB-infected herds and they had to be double-fenced. All those features were relaxed when the whole country became designated free of TB but, of course, the whole country was not free of TB; there were patches of infection which still remained in the West Country which were ascribed to badgers. Whether it is true to ascribe them to badgers or not I do not know.

Professor McInerney: In the last 20 years also there have been quite significant changes in the structure of the cattle economy and herd sizes are very much larger now so that you get infection within a large herd and it can amplify very much more within that herd. Secondly, the statistics show there is a great deal more cattle movement because of the wider trading activities of cattle farming.

Q13 David Taylor: Professor Bourne referred to the smaller number of larger herds and Professor McInerney just referred to the degree of transport. What was the aggregate size in the Sixties when you were talking about 50,000 cattle being slaughtered a year and what happens now as piling into insignificance? What was the size of the national herd then approximately, as opposed to where we are now? That is a factor as well, I would have thought.

Professor Bourne: I do not know. It surely was much greater than now, many more million than that. The size of herds, I do not know. I can only talk from my experience when I was in practice in Cornwall, when the majority of herds were 19, 20, 25 cattle, sometimes less, and a herd of 60 animals was large.

Q14 David Taylor: The aggregate size of the national herd would also be a driver in terms of the statistics, would it not?

Professor Bourne: Yes, surely.

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Q15 Chairman: Just to conclude this section, just to set us on our road, summarise for us, if you would, the current state of your final conclusions.

Professor Bourne: With respect to badger culling, our findings are that localised culling, in whatever form that may take, will not contribute to the control of cattle disease and is likely to make the situation worse. If one considers proactive culling over an area the size of the trial areas, 100 square kilometres, we have demonstrated that within the culled area there is a beneficial effect of 23% and in the peripheral area outside of the culled area there are an increased number of breakdowns to the extent of a 25% increase in breakdowns in that area. That occurs as a result of systematic culling carried out by a professional team over a five-year period where badger removal was about 70-73%, which suggests a trapping efficiency of 80%, which is consistent with the design criteria of the trial, and yet when one translates the numerical number of herds breaking down and those not breaking down, it results in a very small number of herds saved from breaking down over a five-year period, 14 herds over that period being saved from breaking down. That is the difference between those that have not broken down on the inside and the increased number breaking down on the outside. So it is a very modest return for five years culling, sustained, and when that culling is carried out, we have shown that it has to be across the whole patch simultaneously. You cannot do it piecemeal. That worsens the problem.

Q16 Chairman: Just to help me understand the statistics of what you have said, if after five years you have dropped 20%, roll it forward; if you carried on doing it for another five years, what would the statistical drop be?

Professor Donnelly: What we have shown is that we have trends in both the benefit inside the proactive trial areas and also trends outside. So the detrimental effect gets less bad over time and the beneficial effect gets better over time, but we were not able, on the basis of this data, to extrapolate beyond the fourth annual cull. All ten areas received at least four culls, some as many as seven.

Q17 Chairman: Just stop there, because it is quite easy for a non-expert like me to get lost. If after five years you indicated there were two findings: minus 20% in the area which has been culled and plus 25% increase in events occurring outside, across the border, what I wanted to get some feel for is, if you carried on culling in the next five years, and then another five years, what is the trend? Do you ever get to the Nirvana of the extinction of the disease after 20 or 30 years in the culled area and total ravaging outbreak everywhere else? That is what I am trying to get a picture of.

Professor Donnelly: We were able to estimate well after four culls, so the figures that John reported, the 23% and 25%, are averaged over the whole period of the trial. So the best picture that we are able to estimate at the end of this period is a 33% benefit

inside and an 11% detrimental effect outside, and there is a general trend for both of the situations to improve.

Q18 Chairman: I am trying to get the idea. If you devote more time, is there a cumulative benefit?

Professor Woodroffe: Perhaps I can talk to that because, of course, the root of all of this is what is happening to the badgers. What is happening to the badgers is that after about three culls your number of badgers caught per cull plateaus, so you catch most on the first cull, you catch on average fewer on the second and by about the third cull, each time you go back and cull, you are culling a similar number from then on, but what keeps continuing to go up is the proportion of badgers that you catch close to the boundary. So what is happening is that, as you cull the badgers inside the area, more are coming in from the outside. The genetic evidence shows the same. So I think that unless you have some barrier to prevent badgers from re-colonising, probably what is going to happen is that, as fast as you cull the badgers, more come in. We also know that successive repeated culling increases mixing within the badger population, increases TB transmission within the badger population, and so you are going to continue to have a number of badgers present within the area and a higher proportion of those are going to be infected, and my suspicion, based purely on the ecology, is that you are not going to continue down to eradication; you are going to reach some sort of stable point where it does not get any better, unless you had some sort of physical barrier that prevented the badgers from re-colonising and, unfortunately, given that badgers dig and climb, fencing them is extremely difficult. There are very few natural boundaries that would prevent that re-colonisation from occurring.

Q19 Chairman: What I was trying to get some feel for was, if you carried on doing it and at the same time adopted all the measures of bio-security cattle movement, whether in fact you would then crack it; in other words you would say in an area, "Right, we have bottomed this." The message I am getting from you is no.

Professor Woodroffe: Yes, from a badger ecology perspective, no. You cannot eradicate the TB in the badger by culling.

Q20 Mr Williams: Just to take the reasoning of the Chairman a little bit further, as I understand it, the average over the five years or four years was 23% improvement and 25%, but then the actual figures in the fourth or fifth year were 33% less breakdowns and 11% more. It seems to me you are going in the right direction. What we are trying to get to is, is it that the process has not been carried on over a long enough period of time to achieve the most beneficial results?

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Professor Bourne: You are not only considering the time you do it, but that then takes you into the area over which you cull, because you are continually going to get the drain of badgers into the culled area, as Rosie indicated.

Q21 Mr Williams: The ecology of the badger has been explained but the actual numbers of herds breaking down, which is what we are about, in a way, seems to be improving and going in the right direction.

Professor Bourne: If you consider the number of cases actually saved, it is still very, very low.

Q22 Mr Williams: Even per year towards the end of the experiment?

Professor Bourne: Yes.

Q23 Mr Williams: Are those figures in your report?

Professor Woodroffe: After the first cull, if you do the benefit versus the detriment, the detrimental effect in the first year is so huge that in fact if you did proactive culling once, or even twice, your overall outcome is that you just make things worse.

Q24 Mr Williams: What we are saying is that yes, we understand at the beginning, when you remove a huge part of the population and you get lots of movement of badgers, you do not get very good results in terms of herd breakdown but as you are going on, it improves.

Professor McInerney: One of the difficulties that you are groping for is: can we extend on from the five-year experience to another five years and another five years? One can, if one is speculative, but it would be a very dangerous thing to do to extend five years' experience into 20 years. The simple answer to your question, Chairman, is, if you can get 25% of TB removed with five years' culling, can you get another 25% so that in 20 years you have got rid of it? My understanding of the ecology is that no, it is not that simple, which is a pity because if it was that clear, one could at least sit down and say, "OK, can we contemplate a 20-year culling programme? Where might we be and might that be worthwhile?" I would tend to shudder at the cost of a 20-year culling programme given the cost of a five-year culling programme but I can see why one would like to feel that the ability to control the disease could be just rolled on from the five years' experience of this cull.

Q25 Chairman: I ask these questions because among those who will listen and reflect on what is being said, there are those who are entirely with you and those who remain deeply sceptical, and we just have to try and tease out whether in fact the idea of a cumulative policy has any merit.

Professor Bourne: There are other important caveats to this culling programme and those are that the culling is done sequentially on an annual basis by professional teams over a very, very long period. You may wish us to comment further on the

professionalism required, particularly in relation to land access and also the level of trapping efficiency that you might expect to get.

Professor Woodroffe: The level of effort that this took was in the region of 40 trap nights per square kilometre per year for five years, but the way that the trapping was done was not just that you sling out some traps and wait. Bear in mind that not every land holder provided consent to cull. In order to achieve the most effective culling success that we could, traps were deployed around areas of inaccessible land to try to achieve the best removal that we could, including areas that were inaccessible for trapping. That was successful and we were able to show that by culling around those, in patches of accessible land we were able to suck the badgers out, but that sort of process requires a great deal of experience in badger natural history and behaviour, recognising field signs and so on. It is something that professional staff are needed to do. The level of success that we achieved is shown in various different measures: the density of badger field signs, various different measures of badger activity in proactive areas was about 70% lower in the proactive areas towards the end of the trial relative to the areas that were not culled, and bearing in mind this substantial evidence of immigration of badgers into the area, that suggests we are catching more than 70% of them each time, it is just that more keep immigrating. So our trapping efficiency is probably upwards of 80%, I would estimate, on that basis. We have been criticised for having not removed enough of the badgers but a lot of those badgers that are there are ones that came in from outside and we have genetic evidence in support of that.

Professor McInerney: Even if you did go on for five years and five years and five years, at the end of it you would only have managed to eliminate the badger element of TB, and since we do not know exactly how much that would be or how that might change over time, it is very difficult to predict therefore what the TB occurrence would be at the end of a long and extended culling programme.

Q26 Dan Rogerson: We are saying that it is possible potentially to have an impact through quite a large-scale cull in an area but the problem is that it is repopulated. In an area such as, for example, a peninsular, might it be possible to look at what happens if you were looking at tougher measures of controlling it in the herd and also some form of cull in an area that is quite well geographically defined?

Professor Woodroffe: Yes, we can speak directly to that because one of our trial areas was West Cornwall, the Penwith Peninsula, but we had a variety of different trial areas with different permeability of the boundaries to badgers. The extent to which badgers can immigrate into an area certainly influences the course of infection in the badger population over successive culls, so each time you cull the badgers across all the different trial areas, you see on average that the prevalence of infection in badgers goes up. So each time you cull, the prevalence is higher and higher and higher, to the

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extent that by the fourth cull the prevalence in the badgers has roughly doubled and that is to do with mixing of the badgers, breakdown of the social organisation, which causes disease to spread. What we see is that that effect is influenced by this boundary permeability, so in the badgers we see that places like West Penwith, the prevalence in the badgers actually did not rise; it remained roughly constant. So you are really successfully there forcing down the density of infected badgers. Unfortunately, when we looked for a similar effect on the impact of culling on the incidence of TB in cattle, we were not able to detect any effect.

Professor Donnelly: The difficulty, of course, is it was not set up to be able to distinguish within these groups of ten comparisons, so certainly we would expect on the basis of the mechanism that we believe is taking place that it is extrapolation on that basis rather than what we have been able to estimate from the data.

Q27 Dan Rogerson: So it is possible, and farmers in a place like Cornwall who would want to perhaps co-operate in some form of action of this nature, that if measures were taken to deal with it within the herd as well, the testing programme and so on, that some form of a generalised control—

Professor Woodroffe: I would make two comments on that. One is that if we stick with that specific example, which is an area I know well, being from there, that actually of all the areas where we worked in the course of the trial, Triplet F, the West Penwith proactive area, had the lowest land owner consent, far and away; half the area was accessible to us, so if that was the place that we considered the best, that would probably offset the benefits for an area like that. One point to which this is highly relevant is comparison with results from the Republic of Ireland, where there has been a great deal of discussion and speculation over the application of the Irish findings to ours. Of course, one of the key differences between our trial and the trial that was conducted in the Republic of Ireland was that, whereas we chose representative areas of high TB risk to cattle, in setting up the Irish study they chose the areas where they thought that culling was going to work best, and they deliberately chose the four places in Ireland where they could find places with these sort of geographical barriers to badger immigration, and where they could not find barriers like that, they had very substantial areas which they culled but from which they never reported the incidence of cattle TB. What I think that means is, I suspect it is probably the case that those sorts of geographical boundaries might well be expected to influence the impact of badger culling on cattle TB incidence and perhaps a comparison with Ireland might lend support to that. There are very few places in Britain that have those sorts of geographical barriers, so whilst it might be something that is locally potentially of some value, in terms of national TB control it is probably not that useful.

Professor Bourne: You mentioned Ireland. I think there are other issues there which are important in comparing the Irish situation with the one in this country. They certainly have a much lower badger population than we do. In tackling their badger culling they, of course, used snaring and have less welfare considerations than we were forced to give to the trapping that we carried out in the trial. Very importantly, they had 100% farmer co-operation and we did not get that. Defra could not find out who owned 13% of the land area in our trial area, in spite of the resource they have to try and resolve that issue. 13% of the land over here just was untrappable in that sense. The other thing is that there is no badger group in Ireland. The social attitude to the badger over there is totally different to social attitudes here.

Q28 Chairman: We are going to come on to Ireland in a little while. Just on a point of methodology, you have made it very clear to us that peer review—in other words, you are not coming under flak from scientists that in some way your analysis and its conclusions were flawed, but you have just made the point that you had at least half a hand tied behind your back because you could not get 100% land owner co-operation, and you made that point of contrast in relation to the Irish trials. I suppose it is an impossible question to answer but nonetheless, I might ask it: if you had had, were there examples within all of the trials that you did where you got 100% land owner co-operation and, if so, were there any significant differences between the lower order where you did not get that co-operation and those areas where you got a higher percentage of co-operation?

Professor Donnelly: There certainly were no areas with 100% coverage but what we did find was we divided up in further analyses—and this is part of the IJID paper that was just published. We actually looked at farms that were on accessible land versus farms that were on inaccessible land and we did not find a significant difference between them. In fact, the non-significant difference was in the opposite direction to what you would expect, so what we found was that those farms on accessible land actually did slightly worse than on inaccessible. There was nothing in the statistics to show that the benefits were different. The explanation for that is that actually, the vast majority of areas of inaccessible land were very small. So while we had direct access to about 70% of the land area, traps were deliberately placed on the boundaries and about 70% of the remaining land was within 200 metres of accessible land.

Professor Woodroffe: Which is well within the ordinary daily ranging behaviour of badgers. On successive culls we were clearly sucking more and more badgers out from those areas of inaccessible land, so we were pretty convinced that we were removing substantial numbers of badgers from those little pockets of inaccessible land, even though we could not place traps on that land.

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Professor Donnelly: We showed that per square kilometre in the little strips just around the inaccessible land on subsequent culls we actually took out more badgers per square kilometre than on the remainder of the accessible land.

Professor Bourne: It did require trapping expertise to achieve that, of course.

Q29 Mr Cox: I am in danger here of getting into territory that we may explore later but, as I understand your report—help me if I am wrong, Professor Bourne—you have consistently said in this report that though as an instrument of general national policy you take the view that culling is not a cost-effective or sustainable policy, it may be—and I am looking here at number 8 of your general conclusions—that areas with boundaries impermeable to badgers could contribute to TB control on a local scale, although you make the point that, of course, such areas in England are relatively few.

Professor Bourne: There we were referring actually to the odd farm that does build badger-proof boundaries. I am aware that some of these farms do exist in the South West. We recognise that they are expensive and we recognise that although they might make a contribution to that farm, they make no contribution to the national impact.

Q30 Mr Cox: Can we also look at paragraph 5.16 at page 90 of your report, where you deal specifically with the impact of permeability of trial area boundaries. What you seem to conclude there is that your trial, scientifically speaking, can really shed very little light—indeed, you say “currently available data shed no direct light on whether a proactive culling policy would be more beneficial if conducted in more geographically isolated areas”. It follows from that report, if one can take the black and white letters, that in areas which may be geographically isolated or may be otherwise able to be impermeable to the immigration effect, that it is conceivable—and Ireland would seem to support that—that culling might be beneficial.

Professor Woodroffe: Yes. You are absolutely right to pick up the difference between page 90 and page 20 whatever it is, and that is an extrapolation. Within the areas that we actually studied we found no impact of boundary permeability on the effect on cattle, bearing in mind that most of the trial areas had areas that were considered to be 100% permeable to badger immigration.

Q31 Mr Cox: But you had no evidence either way. That is the point.

Professor Woodroffe: We could not detect any effect, but we were able to detect an effect on the badgers themselves and we were able to show that you did not get this rise in the prevalence among the badgers in badger TB prevalence in these areas the badgers could not easily re-colonise, and it was on the basis of that that we extrapolated to suggest that perhaps therefore, if you were to expect culling to work anywhere, that would be where you would expect it,

but we have not detected ourselves in the trial an effect of barrier permeability on TB incidence in cattle.

Q32 Mr Cox: Professor Woodroffe, forgive me, but the report says it sheds no light on whether a proactive culling policy would be more beneficial if conducted in more geographically isolated areas. The conclusion that that states is either way: it might be, it might not be.

Professor Woodroffe: It might be or it might not be. Exactly.

Q33 Mr Drew: Can we move on to policy? Professor Bourne, it would be interesting to know if you have had a discussion with Ministers since the report has been made available?

Professor Bourne: No.

Q34 Mr Drew: So you have not met Ministers?

Professor Bourne: No. I last met Ministers on 1 February.

Q35 Mr Drew: Can we move on then to looking at how the Government may come to its policy evolution. When you were interviewed this morning on *Farming Today*, you were somewhat querulous about how Defra were going to handle the scientific data and then subsequently translate it into policy, given that you felt they did not have a good track record with their attempts to draw up their consultation document. Is there any discussion on how you might help them with that, given that you have not talked to Ministers, but presumably you have talk to officials about how they might be wanting to take policy forward?

Professor Bourne: We have not directly had these discussions, no. I certainly have had more discussions with the scientific expertise within Defra based at VLA and CSL and recognise the quality of that expertise, and I think the frustration they experience in not having adequate opportunity at extending science into practice. You mentioned the consultation exercise. That was just one indicator.

Q36 Mr Drew: It was a fairly important one.

Professor Bourne: Yes. There was an even more important one, and that relates to the discussions we had with Defra in 2001 on work to develop the gamma interferon test. It was apparent at that time that future policy would demand improved diagnostic tests. We discussed with Defra ways in which field data could be gathered to provide information to inform on a range of policy options, and they rejected our proposals and went ahead with a pilot trial on the grounds that they could not afford to do anything else, and you know the outcome of the pilot trial. It did provide some very informative data but it did not inform scientifically in the way one would have hoped. We have advised that there has to be a closer working relationship with scientists, particularly in Defra, to ensure that appropriate data is collected to inform on future policy options. Also, that data available from the

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testing of animals is regularly interrogated with a clear strategic view as to what that data might tell them and how that in turn can be implemented into policy in a way that we have called adaptive management, which really means extending scientific findings into the policy of disease control. We have not seen signs that that has happened and we believe it is critically important that it should. Equally, we have stressed—and I think this is a very important recommendation of the report—that Defra should develop a very clear strategy. At the moment it would claim it does have a strategy, the strategy of reducing the incidence of disease in high-risk areas and preventing its geographical spread, but what are the details of that strategy? It has not really been thought out. I believe there should be a clear strategy of what they want to achieve, what is achievable, what resources are necessary to do that, and this should be driven by a focus group involving scientifically informed individuals driving that, certainly with farmer input because they are important stakeholders, and in that way develop a strategy, sell that strategy to stakeholders and drive it forward in a way that one sets targets and knows where one is going. That would in turn require that the whole thing is costed. I am not aware that Defra have ever costed any policy and determined how the policy can be matched to cost. They have certainly borne the increasing cost of compensation payments but that is not the same as what we are proposing. These are the elements of our proposals which relate to data collection, rigorous and ongoing data analysis and interrogation, and how one uses that to feed into a strategy that has already been focused and you have a group driving it. I do not see the mechanisms within Defra at the moment to do that.

Q37 Mr Drew: What has been your response to ministerial statements, written and oral, that have come out since your report has been published?

Professor Bourne: I was aware of Mr Miliband's statement this morning. I am not aware of any others.

Q38 Mr Drew: What is your response to that? It is fairly anodyne.

Professor Bourne: It does not say anything. If I were a badger welfarist, I would see something there for me and if I were a farmer I would see something there for me but really it did not say anything.

Q39 Mr Drew: In the weeks leading up to the publication we have had everybody spinning against everybody else.

Professor Bourne: That has happened for the last ten years.

Q40 Mr Drew: We have had at least a week of inspired leaks in the press which said that Ministers were going to bite the bullet and were going for large-scale culls. We have now had all the stuff this weekend where effectively Ministers are now saying they do not need to bite the bullet because there is no need for large-scale culls. We have obviously had

various organisations, like the Badger Trust, making its own threepenny-worth. This has not been helpful in trying to get a scientific rationale of your report. You make a comment about that in terms of some of the critics that you have had to deal with over the years. They all seem to have got their retaliation in first. Have any of them helped you at all in trying to make your case?

Professor Bourne: Not at all. Absolutely not. Absolutely and utterly not. I certainly made the case to Ministers, both to Mr Bradshaw and to Mr Miliband, and collectively, in the meetings we had in November last year and February this year that it would really be helpful if Defra embraced the science and stimulated discussions with the NFU in particular based on science to develop science-based policies. I have seen no sign of that. It may be happening in the background but I am not aware that it is happening and, if it is, it has certainly had no impact on the NFU response.

Chairman: Come back on Wednesday and you can see the other side of the coin.

Q41 Mr Gray: I am new to the Committee since you were here in 2006. I have just been reading the papers and forgive me if I have missed something. It seems to me there is a difference in tone between what you said particularly in your letter in 2006 and what you said in your report. If I could just quote a couple of bits that confused me rather, in your open letter of January 2006 you said, "Intensive culling over a large area and over an extended period of time could in principle reduce cattle breakdown rates", which I interpreted to mean that you thought that there could be a place for extensive culling over a long period.

Professor Bourne: Read on.

Q42 Mr Gray: In the second half you say there are logistical difficulties, yes, but let us leave aside—

Professor Bourne: Read on, read on.

Q43 Mr Gray: Perhaps you would like to answer the question in a moment and then you can tell me the bits that I have not actually—

Professor Bourne: The bits that you have missed out said it can only be considered as a policy option with a cost benefit analysis.

Q44 Mr Gray: Professor Bourne, perhaps you would let me ask the question before you seek to answer it.

Professor Bourne: You were quoting a letter and you were not properly quoting that letter.

Q45 Mr Gray: Perhaps I can ask the question. Perhaps that is a better way to do it, ask the question first and then let you answer it. My naïve interpretation of your letter then—and you can correct me in a moment—was that you said that under some circumstances, although there are logistical difficulties attached and there are costs attached, intensive culling, in your words, over a large area over an extended period of time could in principle reduce cattle breakdown rates. Am I wrong

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in thinking that means you think that under some circumstances extensive culling could break down cattle breakdown rates? Is that right or wrong?

Professor Bourne: Mathematical modelling in extrapolation from trial data suggests that if you cull over a large area, you would ultimately get positive gains with respect to the area culled relative to the area that you were not culling, where we know one had this perturbation effect.

Q46 Mr Gray: So the answer is yes.

Professor Bourne: I also stated very clearly in that letter that there would be extreme logistical difficulties in achieving this with respect to culling over a large area repeated regularly over a large period of time, and it could only be considered as a policy option if there was an adequate cost benefit analysis.

Q47 Mr Gray: What sort of logistical difficulties?

Professor Bourne: The logistical difficulties are the ones that we had to face in doing full surveys of these areas, getting a trapping force into the field to do culling across the whole piece at the same time and continuing it for this very long period. There is a real logistical difficulty.

Mr Gray: Hang on a minute. The logistical difficulties of doing it—

Q48 Chairman: Let Professor Bourne answer.

Professor Bourne: We also stated that if one required a cost benefit analysis and we have subsequently been able to do that because we have been able to identify the number of breakdowns that would be saved as a result of this sort of practice and the costs that would be incurred, but the fact the Government stated very clearly that they would not do this themselves, they would not be responsible for this, but farmers would in fact have to do this off their own bat, increases the logistical problems of doing this.

Q49 Mr Gray: Let us leave the logistical difficulties to one side because there is no logistical difficulty in the world that it is not possible to overcome. What I want to focus on is what you said in your January letter, which was that in principle an extensive cull over an extensive period might well be beneficial in terms of reducing TB. That is what you said in your letter. Was that wrong or has the science developed since then?

Professor Bourne: As an extrapolation, as a modelling exercise, that was correct but we are bound to write caveats to that, which I would have thought would have been a clear message to Ministers of the difficulty of doing that and the likelihood that the whole thing just would not be achievable. Subsequently, of course, we have been able to do a cost benefit analysis.

Q50 Mr Gray: We will come back to the cost benefit analysis and cost, of course, is a separate matter but the important principle which has not really come over in the coverage today is that in that letter you

accepted the principle, leaving aside the difficulties, leaving aside the logistics, leaving aside the costs, and those of course are big difficulties, according to my naïve reading of it, that an extensive cull over a wide area might have some benefits for reducing TB, leaving aside the logistics, leaving aside the costs. If that is the case, can I ask you a second question about area—you hinted at it a moment ago but we did not actually develop it quite as much as we perhaps could have done. Given that the tests were over ten square kilometres, and quite good effects were seen inside the ten kilometres squares, although there were bad effects around the border, what would happen if that were very much wider? For example, in the old days it used to be that the cull was across the whole of the county. Imagine that all the badgers in the county of Wiltshire were exterminated, what effect do you think that would have? Do you not think that possibly your tests being in small areas—ten kilometres is a very small area in terms of the land mass of Great Britain—given that you accept the principle that it does actually work, and leaving aside the logistics and leaving aside the costs—we will come back to that in a moment—do you think the small area over which the test was done might have constrained the outcome?

Professor Bourne: If you look at page 105 of report, we express there the confidence limits that extrapolation suggests you might expect with trapping over a very large area. They are very wide confidence intervals. You ask if one culled out the whole of Wiltshire, what would the effect be on the whole of Wiltshire. The data from the trial would suggest that you would have a positive impact on cattle breakdown within the Wiltshire area, and it would be difficult to tell you what that was; one could extrapolate. One sees the very wide confidence intervals. But you would certainly have an unwanted effect in the neighbouring counties of Hampshire, Somerset, Dorset, what counties there are surrounding Wiltshire. Pragmatically, I think, attempting to cull badgers over such a large area would present extreme difficulties, difficulties which we have mentioned, with respect to how you would have to cull that area.

Professor Woodroffe: If I could just continue on the theme that Professor Bourne has started, this issue about logistics is not just a question of you would have to do it and it is always achievable. The problem is what happens if you do not achieve it. If you attempt to cull badgers across the whole of Wiltshire, if you fail to achieve that, if there are chunks that you cannot access, if you do not do it all simultaneously, if you do not do it as we did it in this case, where we had large numbers of people coming in simultaneously over large areas to cull badgers, anything that you do which reduces a simultaneous, very widespread effect risks making the situation worse. So where culling is localised, you get the perturbation effects, you increase TB risk to cattle.

Q51 Mr Cox: Subject to permeability of boundaries.
Professor Woodroffe: Wiltshire being really quite permeable.

Mr Cox: I understand that.

Q52 Mr Gray: There is a lot of rain there.

Professor Woodroffe: So, for example, we showed that, as I mentioned previously, every time you do a proactive cull across the whole area, the prevalence of infection in the badgers goes up on each cull. If you do not do that simultaneously but instead you do that cull as several sectors that you do successively, the increase is actually 1.7 times as much. So if you do not do a simultaneous cull, it makes the situation not just a bit worse but quite a lot worse in the badgers. So simultaneous culling is very important, good land access is very important, targeted culling around inaccessible areas is very important, and everything that you do which, because of logistical constraints, because of lack of land owner compliance, because you are just trying to do something on a massive scale, takes you away from an absolutely simultaneous cull, performed very extensively simultaneously, is going to take you more towards piecemeal culling, which is going to entail a high risk of making the situation worse rather than better. There is a big difference between saying in principle that you could reduce TB risk to cattle by culling badgers over very extensive areas, although within the range of areas we have projected the differences, the net effect is pretty small. The overall effects are very modest but there is also an increasing chance that you make it worse, especially if you are going to do that as one of the culling approaches that was formerly included in the consultation document was licensing farmers or farmers' representatives to do the culling. Without the resources of being a large government department, farmers trying to do it themselves or having contractors trying to do it themselves and so forth is going to take you more towards this piecemeal culling, which will have a massive risk of making things worse rather than better.

Q53 Mr Gray: I see the logistical difficulties but you get my point that if there were to be in principle benefit from it and given that this is costing the nation millions of pounds, it might well be we could devote huge resources to it if indeed it was going to be the final solution. Is there not some argument in favour of doing that? Is that something which you considered?

Professor Bourne: One could certainly do that, just as the Irish plan to remove badgers from 30% of their land mass.

Professor Woodroffe: I am actually not sure that it is even achievable given the badger densities we have in TB infected areas of Britain, the lack of geographical boundaries. I think another difference between Britain and Ireland is that we have substantially higher baseline background badger density, so that immigration pressure is always going to be there. I am not convinced that you actually could eliminate badgers from Wiltshire, try as you might.

Professor Bourne: The feasibility of it is extremely difficult but also, of course, it would not be the end of the cattle TB problem. It would make cattle TB

controls very much easier but there would still be a very large cattle TB problem that would have to be addressed through improved diagnosis.

Mr Gray: They have brought it to one strand.

Mr Cox: You would have to bear down on both sides of the disease.

Q54 David Taylor: My colleague Mr Gray has been trying to tease out whether there really were differences in time in the ISG's attitude between January 2006 and 18 months later, as we are now. I would like to see if there are differences within the ISG. I know it is not a seminar on semiology but nevertheless, can I point to Professor Bourne's letter to the Secretary of State where he refers to "badger culling can make no meaningful contribution to cattle TB control in Britain", which is drawn from paragraph 9 of the overview, where you mention a very similar point, "cannot meaningfully contribute towards future control", but yet, rather significantly, at paragraph 10.48 on page 172 we, the collective Committee, concluded that badger culling is unlikely to contribute positively. "Unlikely" and "cannot" are two distinctly different descriptions. I wonder what lies within the two different boundaries that they represent, Professor Bourne.

Professor Woodroffe: As the author of several of these sentences, I am very happy to speak to them. I will just add while Professor Bourne is looking it up that saying badger culling is unlikely to contribute positively in a scientific forum is pretty damning. That is about as strongly as you ever say anything in a scientific paper.

Q55 David Taylor: It is not the Chairman firming it up; it is just a scientifically alternative way of expressing the same set of circumstances?

Professor Bourne: No, I think there are two issues here. What we are saying is that badger culling, in the way it can be conducted in the UK, we believe, cannot possibly contribute to cattle TB control, and in using the word "meaningfully", what we mean there is that if it is the only inducement that would encourage farmers to co-operate fully and introduce effective cattle control, it could have an effect.

Q56 David Taylor: There is a difference to me between "cannot", which is a zero percentage probability and "unlikely", which is less than a 50% possibility. There is a big void there, is there not?

Professor Woodroffe: There certainly is not any disagreement within the group about the conclusions.

Professor McInerney: It is important to get a little perspective on this. In 2006 when the letter was written, a certain amount of data came through and the analysis was leading to some conclusions. By the time we get to our final report, there is a lot more data. The trends inside and outside the areas have become more firm. Whereas in 2006 the net effect on breakdowns was that the outside effects were neutralising the inside ones, as the trends have developed, we now find within 100 kilometres squared there is a net positive effect, but it is 1.4

breakdowns out of 50. This is where we do not think it is meaningful, if you believe it is worth throwing all this culling effort in order to prevent one and a bit breakdowns. We do not feel that is very meaningful in terms of policy. It is the raw numbers of what you achieve rather than technically whether it is zero or just a little bit above zero. In the end, our judgment is that this is not a very effective policy if all it achieves, after all this effort, is a minimal effect on breakdowns when there would seem to be opportunity to have a much bigger effect doing other things.

Q57 David Taylor: To me, as a statistician, an equivalent phrase to “cannot meaningfully” would be “is highly unlikely to contribute positively”.

Professor Bourne: We are working within scientific confidence limits.

Q58 David Taylor: 95%?

Professor Bourne: Yes indeed. It is difficult to be utterly positive about everything.

Q59 David Taylor: “Cannot” is utterly confident to me.

Professor Bourne: We are confident that it will make no useful contribution.

Q60 Chairman: Can I make quite certain that my ears did not deceive me a moment ago when you said with your almost impish smile, “Left to its own devices, culling is not the silver bullet but if it induced some other activity as a *quid pro quo* it might have a role to play”? Is that what you were communicating to me?

Professor Bourne: It would be very unfortunate if that happened but that is exactly what I was communicating to you because farmers have made it clear they will not co-operate unless they can kill a few badgers. Farmer co-operation is absolutely essential to get this disease under control. It will be an appalling thing for us if farmers were given the opportunity of knocking off a few badgers just to get their co-operation.

Q61 David Taylor: Professor Woodroffe used the phrase “a thin strip round the 100 square kilometre area.” What do you have in mind by “thin strip”? In the 100 kilometre area what might be the typical population of badgers and how thin is the strip in terms of dispersal, as it were?

Professor Woodroffe: You would have about 400 or 500 badgers within a 100 square kilometre area. Are we talking about how many in the peripheral area?

Q62 David Taylor: Yes. How big is that peripheral area?

Professor Bourne: In the 100 square kilometres, the radius is 5.64 and the periphery is two kilometres.

Professor Woodroffe: We detect effects of culling on badger population density and ranging behaviour as far as we looked, which was two kilometres outside the cull area. We have searched for evidence of impact on cattle and what we see is that most of the

effects on cattle are within that two kilometres and they do not seem to go further than that. The genetic evidence suggests that on later culls badgers are coming regularly from four or five kilometres away.

Q63 Mr Gray: Why are we using kilometres rather than miles?

Professor Woodroffe: Because scientists work in SI units. We are in the European Union now.

Professor Bourne: The total area of two kilometres periphery is about 80% of the inside core area.

David Taylor: I thought it was more like 45.

Q64 Mr Cox: I must pick you up on something you just said, Professor Bourne, which I have to say on reflection I would invite you to reconsider. You said, “Farmers have indicated that they will not co-operate unless they can kill a few badgers.” That is as flippant a remark as I have heard given against a community of people who are very decent and law abiding, under enormous pressure, and I do believe that you should reconsider that astonishing remark.

Professor Bourne: Maybe so, but—

Q65 Mr Cox: Do you reconsider it or not?

Professor Bourne: Yes, I do. Farmers have consistently stated they will not co-operate with Government in developing improved cattle controls unless there is culling of badgers.

Q66 Mr Cox: I simply do not accept that as a version. At the moment on the evidence as it exists, the farming community as I understand their position believe that there is a role for culling. We will look at your new report and we will see what Defra does by way of the development of policy but I do not think it assists the debate and it certainly does not help the confidence of the farming community in the integrity of your conclusions to make remarks like that.

Professor Bourne: The farming community consistently believe, as you say, that culling has a part to play in reducing cattle TB in spite of the scientific evidence which shows that localised culling has no contribution to make except to make it worse.

Q67 Mr Cox: Let us take as a given that you believe in the conclusions that your group has reached. That does not mean, with respect, that there cannot be legitimate room for disagreement or indeed room for consideration that further research might yield different results. This is the question I really want to come to you about: that you have not in the way in which you have reached your conclusions had to take into account social factors which you overtly and explicitly do. A farmer looking at this will see the results in Ireland and see that dramatic effects can be achieved within the four areas and then be told by your group, because it is clear throughout your report that you do say this, that one of the essential distinctions between Ireland and England is that culling on the scale that Ireland are contemplating would not be socially acceptable. Indeed, you have said that today. If it were possible

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for a government, let us say, to take compulsory powers to achieve the type of culling mentioned by Professor Woodroffe, simultaneous, across a wide area to achieve elimination over a significant tract of territory, it looks does it not from the Irish results and from your own conclusions that there could be, on the incidence in cattle, some significant effect?

Professor Bourne: Yes. I responded to that in relation to the question asked by Mr Gray. Clearly it is possible to take badgers out over large areas if there is a will to do it. Professor Woodroffe suggested that even that would be impossible to do in this country.

Q68 Mr Cox: “In this country” meaning across the country as a whole.

Professor Bourne: We are talking about the county of Wiltshire. The other question is what level of impact would you expect on cattle TB. The four areas trial gives a range of figures. It is difficult to quantify exactly what the contribution of culling is because of the way the science was designed and conducted. Professor Donnelly has carried out an analysis which suggests the reduction in cattle TB incidence is possibly about 50%. I was speaking with the individual running the Irish TB control programme a week ago, along with Professor Donnelly and Sir David Cox, and the question was asked, “What is happening in the trial areas with respect to cattle TB incidence?” He said, “Well, it is not very clear. It seems to have reduced and now it seems to be plateauing off.” It is unclear what impact culling of badgers is having on Ireland. We will have to wait and see.

Q69 Mr Cox: The published science on it is clear.

Professor Woodroffe: Could I clarify that? You referred to the effects detected in Ireland as dramatic and it is true that some of the headline figures—

Q70 Mr Cox: Significant.

Professor Woodroffe:—that are quoted in that scientific paper are dramatic. There are numbers like 95% banded around. That was for one of their areas in one of the years. I would like to add a note of caution and draw attention to some issues concerning the interpretation of results from Ireland. You will be aware from looking over our report that one of the effects we detected was that, as you move deeper into our trial areas, the effect of culling appears to improve. There is a trend suggesting that as you go deeper in you get more beneficial effects on cattle TB, which is consistent with finding this greater reduction of badger population density in those areas and smaller effects on badger prevalence and infection. All of that is consistent. In Ireland, where they were not able to identify an area that was completely bounded by geographical barriers to badgers, they had what they call buffer areas and these buffer areas were six kilometres wide.

Q71 Mr Cox: They took out at the same level as the removal areas.

Professor Woodroffe: They have never published the cattle incidence data from those areas.

Q72 Mr Cox: I understand it exists.

Professor Woodroffe: I am sure the data must exist but those data were never published.

Q73 Mr Cox: If it were inconsistent with their conclusions, it would be scientifically dishonest, would it not? What are you suggesting?

Professor Woodroffe: I am suggesting that we would love to see those data.

Q74 Mr Cox: These are reputable scientists. If the data was contradicted by information in their possession which they have not published, it would be scientifically dishonest. Are you seriously suggesting that the Irish scientists are capable of that type of deception?

Professor Woodroffe: No, I am not accusing anybody of deception. Their peer-reviewed paper does not include that information which would be informative to the debate.

Professor Bourne: What we are suggesting is the assessment we presented to ministers, when the Irish data was published in 2006. There is evidence for a substantial impact on cattle TB incidence as a result of culling in the four areas trial but it is not possible to be precise about the extent of that impact—

Q75 Mr Cox: You are saying you do not have all the data.

Professor Bourne:—because of trial design and data accumulated and the way that data was analysed.

Q76 Mr Cox: The Irish trial was reviewed, was it not, by Professor Godfray against whom I appreciate you have already registered a number of criticisms? He presented a report of the four areas culling trial in which he and his panel expressed themselves to be entirely satisfied, not necessarily with the entire quantitative data, but with the conclusion that very significant results had been achieved.

Professor Bourne: Which is totally consistent with the report we presented to ministers and consistent with exactly what we are saying now.

Q77 Mr Cox: There we sit with the farming community looking across the Irish Sea and seeing that, with a will, with a different social attitude to quote the expression that your report uses, genuine, significant effects can be made with the instrument of culling. That is how they will see it, is it not?

Professor Bourne: Of course. Let me remind you: in the report we do make the point that elimination of badgers, or culling to virtual elimination cannot make an impact. We accept that elimination of badgers would make an impact if it was achievable. Let me take you back to 1999 when we started this work. It was made very clear to us by ministers of the day—and they have not refuted it since—that elimination of badgers over large tracts of the countryside was not an option for future policy.

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Q78 Mr Cox: Is it not the function of science—?

Professor Bourne: It was on that basis that we designed the trial. We also had to take into account welfare considerations with respect to method of culling used and limitations on culling with respect to ensuring that cubs were not killed or died underground.

Q79 Mr Cox: You had a closed season.

Professor Bourne: Yes. Those were the clear, political limitations that we operated under. I have no reason to believe that those political limitations have been changed.

Q80 Mr Cox: You make an extremely fair point. That of course does not always come out in the publication of your results. Is it not the function of science to present a list of options to the Government and allow the politicians to decide what is politically unacceptable? The danger about the interpretation of your report from those who are listening to this and reading it is that you have concluded, as a matter of science, that it can be of no effect. In fact, your conclusions are substantially affected by political and social limitations imposed on them.

Professor Bourne: We repeatedly say “culling as conducted in the trial.” It is important we do say that. Those limitations were not imposed by ourselves. They were imposed by politicians.

Professor Woodroffe: I would like to acknowledge the work of the Defra Wildlife Unit who are the people that did this work.

Q81 Mr Cox: Most of them have been sacked of course.

Professor Woodroffe: Absolutely. They are the people who were confronting animal rights activists on a daily basis and in some cases were being physically threatened. Having been out with them and seen it at the sharp end, I have enormous respect for them. That is an important influence on what is possible and achievable in this country and that is different in Ireland. It is not just a question of politicians making a decision about how things are going to happen. There is a public response that has to be taken into account in planning the logistics.

Q82 Mr Cox: One thing is for certain: the public response might change if it turned out that bovine TB started in a significant way to affect human health.

Professor Bourne: Absolutely.

Q83 Mr Cox: I appreciate it appears from your report, to the educated reader, that you have been set these social and political parameters in which your conclusions are ultimately delivered.

Professor Bourne: We do extend that and we accept that elimination of badgers would have an impact in the way it can be achieved using techniques we have used in the trial. We are extending those techniques to other operations which would include the same welfare constraints.

Professor Woodroffe: We have also considered in the course of our report to what extent greater reductions in badger population densities would improve the effect on cattle TB incidence. Given the substantially higher badger population densities in British agricultural environments, given the lack of geographical barriers to immigration, achieving elimination would be extraordinarily difficult, even if you were using snares or gas.

Q84 Mr Cox: Your data on densities is not particularly good, is it? I read the part of your report that deals with it. You concluded 40% of English conditions in Ireland?

Professor Woodroffe: We compared the sett densities in the British and the Irish areas prior to culling and we also compared the capture rates.

Q85 Mr Cox: The main sett densities were not too dissimilar, were they?

Professor Woodroffe: No, the main sett densities are not such a good indicator of badger numbers.

Q86 Mr Drew: I have some difficulty with the Irish trial because it has been so spun by both sides. It is difficult to know what the reality is. It is good to re-read the scientific evidence. Unless I have this wrong, the one thing I understood from the Irish trial was that at the end they determined that a culling policy was unsustainable. Is that true or not?

Professor Bourne: Correct, but nonetheless they are extending culling to the point of elimination in 30% of land mass.

Q87 Mr Drew: Even though it is an unsustainable policy?

Professor Bourne: Yes.

Q88 Mr Cox: It is unsustainable in the long term.

Professor Bourne: They are calling it a reactive policy. It is reactive in name but in effect it is to eliminate badgers over 30% of land mass. Their argument is, “We are not contravening the Bern Convention because we are not touching badgers on 70% of the land mass.” I do not know what the Bern Convention will say about that. I have no idea.

Q89 Mr Cox: Can we be accurate because it is important that we are accurate. In fact, the Government’s official policy in Ireland is that an effective scheme to control tuberculosis in badgers with which cattle may come into contact is now recognised as a prerequisite for the eradication of tuberculosis from the Irish cattle population. That is the official statement from the Irish Government. It is true that the scientists like Griffin have said that it is not sustainable in the long term and they call for a vaccine.

Professor Bourne: The comments I make in my chairman’s overview which relate to 30% elimination I cleared and had written by the guy who is running the TB control programme in Ireland, because I was sensitive about that very point.

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Q90 Mr Cox: You are absolutely right that they are saying 30%, from my contact with them.

Professor Bourne: He said it was in the public domain and he directed me to the publication where that is absolutely stated. I doubly checked with him: “Are you absolutely sure I can say this? Will you be offended if I say this?” He said, “No, that is absolutely our strategy.” At the end of the day I think you have to accept that it is the price society puts on the badger. Clearly in Ireland society has opted not to put a price on the badger. In this country there is a price on the badger and also on badger welfare.

Q91 Mr Cox: I beg your pardon: they put a price on it in terms of the suffering of the families and the slaughter of tens of thousands of cattle.

Professor Bourne: Whatever has driven that I do not know but the fact is that a price has been put on the badger in this country which related to the way we were able to carry out our scientific work. That is exactly what we report.

Q92 Chairman: The message I am getting is that everything you have said is drawn from and is consistent with the findings of the work that you were asked to do. You are not saying to us that the options to do whatever they want to do are not still available to ministers if they were so minded, having listened to what you have said and any other trial or intervention. If they want to come up with a strategy that involves every known possible contributory element to the ultimate elimination of bovine TB, it is up to ministers to choose. You are one part of the menu of information and opportunity. You have delineated in clear terms what your findings are within the terms that you were asked to look at.

Professor Bourne: That is true, except that by extending our experience from the trial to large areas we are pretty clear about the necessity of culling over a very large area systematically and sequentially for a very, very long time, still maintaining an edge effect so there would be winners and losers. That could have an impact on cattle TB. At the other extreme, it is elimination of badgers across large tracts of the countryside to a point where you will find no badgers or no badgers with TB.

Q93 Chairman: Even if you followed your thesis of where you think that culling would work, your conclusion was that there are not going to be that many incidents of bovine TB that would be reduced. Is that right?

Professor Bourne: Exactly. That is the whole point of chapter nine.

Q94 Mr Gray: On the question of spin or PR, I know it is not your area of expertise but for example you were talking on the *Today Programme* this morning. You said that culling has “nothing to offer in terms of controlling cattle disease. Culling does not provide the answer.” What you meant, in the light of the conversation we have just had, is that under the circumstances—namely, small areas; secondly, no

extensive culling across the nation; thirdly, the eradication of the kind we have been talking about, no cubs and all these other things you describe—“under the constraints I was given by ministers, culling has no role to play. In fact, under other circumstances, outside what ministers have said, outside the political arena, it might.” Do you not think it would have been better to have said that scientifically there may be a way in which culling would work but I am very sorry; society is not—?

Professor Bourne: My introductory statement to *Farming Today* which was not recorded was that one cannot do justice to a 278 page report in a few minutes on *Farming Today*. After giving that interview to *Farming Today*, I e-mailed my colleagues and said, “I really threw caution to the wind today by giving *Farming Today* a 45 minute interview knowing that they would editorially select exactly what they wanted.” I understand what you are saying but you have to appreciate we are in the hands of an editorial team. It was exactly the same with the *Today* guy.

Chairman: We will set up the Quoted Out of Context Organisation to offer comfort and sympathy to each other.

Q95 Mr Gray: We know all about that but do you not think that the overall impression, because of that process you describe of selectivity, coming out of *Today* and all the newspapers is that badger culling does not work but what you should have said is that badger culling does not work under the circumstances that were described to us?

Professor Woodroffe: Having been the person who took the lead on exploring every form of badger culling that we could come up with that has ever been suggested to us, you make many presentations and every time you give a talk somebody says to you, “Would it not work if you did it this way?” or “Could you not do that?” We have considered systematically every form of badger culling that we, colleagues or opponents could come up with. We have evaluated that in terms not only of our findings from the randomised badger culling trial but also in the light of findings from Ireland, Thornbury and East Offaly.

Q96 Mr Cox: Hartland?

Professor Woodroffe: We are familiar with all of the evidence. Interpreting that in the framework of what we now understand on the basis of this nearly ten years of work about the deep, underlying mechanisms that run the dynamics of bovine TB within cattle and badgers in agricultural ecosystems in Britain, we reached the conclusion that badger culling could not contribute meaningfully to TB control.

Q97 Mr Cox: Except in localised areas.

Professor Woodroffe: In geographically isolated areas, perhaps it might.

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Q98 Mr Cox: You have said that.

Professor Bourne: That related to areas that have been badger proofed.

Q99 Mr Cox: We have looked at 5.16 where there may be impermeable barriers.

Professor Bourne: We also explain that it is difficult to identify.

Chairman: It is quite clear that we are still in the work in progress area. We have another session on Wednesday and we have to go and speak to the Minister. I think it is time we moved on to other measures, principally to vaccination.

Q100 Mr Drew: I am interested because it is my area that has a trial under way. As you will know, where we have run into arguments both with yourself and Defra is that we always call for plan B. We never specified what plan B was going to be. I am pretty sure I know what plan B is going to be. It is going to be vaccination. The problem is we are always ten years away and we are always debating: should it be cattle or badgers that are vaccinated. If I was to have more than a hunch—I have spent my life arguing this—we have to get that vaccine in place. Everybody, including the Irish, would agree that vaccination long term is the only sustainable policy. Why do we not try much harder to get a vaccine? My argument would be a vaccine to be used in badgers rather than cattle because of the problems with vaccination of cattle and TB free status and so on. Why do we not just go for that and move it forward more quickly? Forget the rest of this because to cull or not to cull is not any longer a question. Let us go for vaccination and try and persuade Defra to put some serious resources into this and hope that it does pay dividends. It did with human beings, after all.

Professor Bourne: It has not yet. Defra are doing exactly that. We carried out a review of vaccination, as you know, which we published in 2003 with the expectancy that that work would continue over a long time frame before it led to any extension into the field. We produced a full report with the expectancy that another group other than us would pick it up and take it forward way beyond the life of the ISG. That has happened. Defra have a group in place to extend this work. We have only briefly commented on vaccination in our report to emphasise the main findings of the document that we published in 2003 and to emphasise the problems of getting a badger vaccine into the field and particularly in collating data and evidence that the vaccine was achieving what we hoped it would achieve in respect to reducing cattle breakdowns. It is a very long haul. I think it is unfair to suggest that not enough scientific effort is being directed into this area. Internationally, there is a massive global programme. The scientists at VLA of a very high calibre are closely linked into that programme as indeed are the guys who are sitting on that Vaccine Committee at the moment. Success demands a number of things. With respect to developing a badger vaccine, it does require developing a way of getting this to badgers in the field. We know there are

serious limitations for BCG but no one suggests it does not have a role. Measuring the contribution it makes is difficult. With respect to getting improved vaccines, you are waiting for scientific breakthroughs and you cannot predict those. Even when one has a cattle vaccine, there has to be a clear strategy for how you are going to use that in cattle. I am not persuaded that Defra have given this any thought at all. They have not given it any thought at all yet.

Q101 Mr Williams: The Chairman and I met with the president of the Royal College of Veterinary Surgeons the other day and we asked her about this and whether there was a technical problem in getting a breakthrough. The Chairman will correct me if I am wrong but the response was that the real problem is the cost between taking it from the laboratory to getting it to market and all the regulatory processes that have to take place then. We asked her, “What do you think the cost would be?” She said, “Perhaps £20 million.” If you look at that in relation to what it is costing this country in terms of TB at the moment, it would seem to me that that would be a very little contribution to solving a big problem.

Professor Bourne: I am sure she is right about the market. It would be extremely limited because no other European country—

Q102 Mr Williams: The process of taking it from—

Professor Bourne: In fairness, you really should talk to the committee that is now in place driving the vaccine programme. I would certainly give that our total support, as we have. I would also highlight that again there is no quick fix here. It is going to be a long haul.

Q103 Chairman: One of the points that the president did make to us was that the requirements of the vaccine as defined by Defra in their judgment—I hope they do not mind us quoting around lunch table conversation, because the information may not have been given with the rigour that would have been the case had they been giving evidence to us—and the impression I gained was that what this vaccine was supposed to be doing, if you like, the performance criteria, had been set at such a high level that going back to using BCG, for example, would not score. In other words, it was not good enough to achieve the kinds of results that they would say were effective. The vets were saying, “It is better than anything and it has worked in human beings.”

Professor Bourne: I do not think that is true. That is not the approach that Defra are taking. My understanding is that they are developing the possibility of a BCG vaccine to use in badgers. The situation in cattle is very different.

Q104 Chairman: It is currently costing Defra £90 million a year to deal with the consequences of this disease against a current background where all the ways to mitigate it do not seem to be having any serious effect. You might say, “If the Government

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wanted in the long term to save themselves a shed load of cash, they would bung a great deal more money at it to try and crack it now.”

Professor Bourne: I do not think that is the answer. You should speak to the group driving this programme. From my perspective, I am quite assured of the competence of the scientists and the group. Throwing more money at the problem is not going to provide the answer. They are effectively linked into an international network that is massively funded. You just have to wait for science to deliver. Defra meanwhile, from my knowledge, are pursuing the option of using a BCG vaccine in badgers and developing appropriate delivery systems. At the moment they are looking at aspects of safety control for purposes of registration. I do urge you to speak to the group that has now taken on responsibility for this work.

Professor Woodroffe: To add a note of caution on vaccination, it would be marvellous if you could vaccinate badgers effectively. In New Zealand, they have something called a possum puffer, used for remotely delivering the vaccine to possums. One issue you have to confront is that, if you are putting vaccine out in the environment for badgers to consume, there is a strong risk of cattle encountering it and therefore becoming sensitive to the test. It is not all roses.

Mr Williams: Professor Bourne this morning said that with improved testing there could be a reduction in TB incidence without badger culling. What is the scientific evidence for that? Is that an extrapolation or does that have real substance?

Chairman: Mr Rogerson wanted to add to that with a point about the gamma interferon testing.

Q105 Dan Rogerson: There is quite a lot in here about what could be done to speed things up to be far more accurate by a combination of testing.

Professor Bourne: It is based upon cattle pathogenesis findings which are documented in the report in one of the appendices, work that is being carried out primarily in laboratories of VLA in Weybridge, Stormont and IAH. It is also extrapolation, taking information from a simple model that Sir David Cox has developed and using that model to predict how the application of these techniques would influence the curve with respect to the reproduction rate of the disease. He determined a reproduction rate of 1.1. That relates to between herd transfer, not within herd amplification of the disease. That figure has also been arrived at by an independent approach, developed by the workers at the University of Warwick, which does suggest that an effort to improve diagnosis would tip the balance and bring the reproduction rate below one and bring a downward trend to the incidence of the cattle disease. He also postulates from the model that improving diagnostic sensitivity would have a speedier effect on reducing the incidence of disease. As one is talking about herd to herd transmission, animal movement controls as well as diagnosis are important components of that.

Professor Donnelly: In terms of the way the model works, essentially what you are looking at is trying to shorten the time between a herd becoming infected and it being cleared. Improving test sensitivity is one way of doing that so you are sure you are not missing anything. You can talk about it as a herd test but if there is only one animal in a herd that is infected it is the per animal accuracy that matters. Either improving the sensitivity—that is, the proportion of infected animals that are correctly detected—or testing more frequently, so shortening test intervals. Those two things, especially if they are combined together, reduce the time that a herd spends potentially infectious to other herds and in circulation. Obviously since that work was done pre-movement testing has been brought in and we have discussed the possibility of doing that with more sensitive tests and even the possibility of adding in post-movement testing, which would add another level of security. From that modelling work, it showed 1.1 as the figure that characterises the rate of increase of the disease. Estimating the reproduction number has been used in many other human and animal diseases but it allows you to say that one is the threshold of where you just have continuing disease at a level. If you could do things so that the model predicts it goes below one, that suggests not that you would get instant eradication but that you would start on a decline. Both faster testing and improved testing through greater sensitivity are predicted to do that.

Q106 Mr Cox: Perhaps somebody could deal with the question of the edge effect and the 25% incidence outside the culling areas. There was a question by a number of epidemiologists that the findings of that 25% did not seem to have sufficient of a time lag in order to produce the effects that were observed. I am sure that is easily dealt with by you because you will have heard it before and therefore you will have devised some thinking.

Professor Woodroffe: We know that to cause that effect badgers have to start ranging more widely, contacting one another more often and contacting cattle more often. That happens within the course of a few days in response to culling. What has to happen next is that cattle have to be tested. They have to become exposed and develop sensitivity to the test. That takes about three weeks. We have published the sequence of events and it has gone through peer review.

Q107 Mr Cox: You would argue that the period is relatively short?

Professor Woodroffe: Yes.

Professor Bourne: Our remit throughout our study has not been badger protection. It has been control of cattle TB. That has been our driving force throughout the work we have done. How can one best control cattle TB? Our whole report is directed to cattle TB control.

Chairman: Can I thank you very much indeed for

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your final appearance before us as the Independent Scientific Group? As individuals and experts it may not be your final appearance before the Committee.

Thank you very much indeed, as always, for your contribution and your patience in dealing with our questions. We appreciate it very much.

Wednesday 20 June 2007

Members present:

Mr Michael Jack, in the Chair

Mr David Drew
Mr James Gray
Patrick Hall
Mrs Madeleine Moon

Sir Peter Soulsby
David Taylor
Mr Roger Williams

Witnesses: **Dr Richard Yarnell**, Chief Executive, and **Mr Trevor Lawson**, Media Adviser, Badger Trust, and **Mr Colin Booty**, Senior Scientific Officer (Wildlife) and **Ms Claire Robinson**, Government Relations Manager, Royal Society for the Prevention of Cruelty to Animals (RSPCA), gave evidence.

Q108 Chairman: Good afternoon ladies and gentlemen. I am delighted to see so many people here. Just in case anybody is under any illusion, we are not dealing with venture capital trusts, we are dealing with something just as interesting, which is TB in cattle and the relationships between cattle and badgers. So, if anybody wants to leave now, please go! If not, we would welcome your attendance. In that context, may I particularly welcome our first panel of witnesses from the Badger Trust, Dr Richard Yarnell, their Chief Executive, and Mr Trevor Lawson, their media adviser, and from the Royal Society for the Prevention of Cruelty to Animals, Colin Booty, their Senior Scientific Officer, and Claire Robinson, their Government Relations Manager. Thank you very much indeed for coming. This is the second oral evidence session that we have had on this subject following the publication of the Independent Scientific Group's findings. We have, as colleagues will know, also got the National Farmers' Union with us this afternoon. Could I put to our panel, to start, a very simple question? What is your reaction to the ISG's report?

Dr Yarnell: The Badger Trust's reaction to the ISG's report is that it is a very in depth and well put together report. We find the science that has been conducted has been done very well.

Q109 Chairman: Could I ask you to speak up a little bit because the acoustics in these rooms is not brilliant and we would love to hear what you have to say.

Dr Yarnell: The scientific evidence presented in the report seems sound, the majority of it has been published in international peer reviews and we have no qualms with the quality of the science. In terms of the recommendations, we are particularly pleased to see that they recommend a further focus on cattle testing and highlight the large reservoir that remains within the national herd, and, on those bases, we are very pleased with the scope of the report.

Q110 Chairman: Does that go for the RSPCA?

Mr Booty: We would agree with much of that, yes. I would perhaps preface my remarks with a caveat that the report is a weighty report, in both senses of the word.

Q111 Chairman: It is.

Mr Booty: I personally have not had a chance to fully absorb and analyse the 300 pages yet. I think it needs and merits a proper consideration rather than hasty examination and hasty judgments, but, that point aside, our view is that it is a solid piece of work, very sound science. As my colleague from the Badger Trust pointed out, much of the work is already in the scientific domain, it has been in international peer review journals and is regarded, in a sense, as very good quality science, and as the RSPCA we are accepting overall the conclusions and recommendations of the report.

Q112 Chairman: You made an interesting observation a second ago when you said it is a weighty tome and it needs, effectively, careful evaluation.

Mr Booty: Thank you very much.

Q113 Chairman: What needs to be evaluated from it if it has got the clarity of result which you would, effectively, say from your standpoint goes in the right direction? Certainly Mr Yarnell was unambiguous in saying that he was praiseworthy of the document; he accepted its conclusions and he underscored its scientific validity.

Mr Booty: Which I would endorse. I made the caveat because, in a sense, there is a lot of data in there, a lot of complex argument, et cetera, which I think would merit close examination. The broad approach is yes.

Q114 Chairman: Who should do that?

Mr Booty: In the first instance, it falls to Defra to do that, and Defra have argued that they are going to base their policy on sound science. This, in our view, gives Defra the sound science on which they have the opportunity.

Q115 Chairman: It gives Defra the sound science which was, if you like, initiated by virtue of the Krebs trials, the work that has gone on, the scientific criteria which the ISG have been working to. When I heard that it is going to be based on sound science the question that came into my mind is: is there any other science that might be considered to be scientifically sound but which might come up with another view? I could not immediately think of any,

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but it was, if you like, a logically consistent question to ask. Perhaps you can help me. Is there any other science lurking out there?

Mr Booty: I can see how you might be of that point of view, but perhaps Defra can offer a definition of what they regard as “sound science”. I think in the scientific field some science is regarded as more equal than others; it has a higher standing. Journals have different weightings, they have different scientific criteria, they have different credibility and the journals in which some of this work has appeared—we are talking about the journal *Nature*, *The American Proceedings of the National Academy of Sciences*, *The Journal of Applied Ecology*—are all top-flight, top-rank journals, and that is what I would regard by sound science.

Q116 Chairman: Certainly Professor Mollinson, having now had the chance myself to read his little treatise, is quite clear that the science is good in terms of the way the analysis of the statistics of this has been carried out, but you will not be surprised to learn, and some of them are sitting behind you. They are still sitting there, do not worry.

Mr Booty: I cannot feel anything just yet!

Q117 Chairman: They have a very different view. In fact, the, as usual, robust Mr Anthony Gibson of the National Farmers’ Union said “Professor Bourne’s report is a council of despair”, and he said, with his novel robustness, “We are not prepared to accept it.” What is your reaction from your respective organisations to those kinds of comments from those who are actually in favour of culling as a solution as opposed to the principal findings of the ISG?

Mr Booty: I think my inclination is to leave the NFU, in the follow-up session, to explain how they get to their particular point of view. I would like to go back to your question about sound science. You mention Professor Mollinson. Professor Mollinson is part of the process which this trial and associated work has gone through and not only have you had this Independent Scientific Group putting the work together, it has been independently audited throughout with Professor Mollinson being the statistical auditor (the field work was also audited and the humaneness aspects were audited by three different individuals). When the results were available they were submitted to these internationally recognised journals, subjected to critical peer review—that is all part of the process of why this is sound science—and, in addition, the data on which the ISG drew those conclusions has been made publicly available in the appendices in supplementary documents to those published papers, which I am sure the ISG may well have explained to you in the previous session.

Q118 Chairman: Dr Yarnell and Mr Lawson, you have had a chance to consult, what would you like to tell us?

Dr Yarnell: First of all, I do not see this as a document for despair, I see this as a huge step forward in terms of common strategies to control the

spread of TB, and there are some very sound recommendations that Defra needs to consider and investigate fully to see how they can possibly implement some of these decisions. Trevor, you were going to add something.

Mr Lawson: In terms of the NFU’s perspective, having dealt with the NFU on a media basis for a long time, what we have not seen, as far as we can tell, is a scientific argument against the conclusions in the report from the NFU, and I think that is a critical factor. The data is there. Other scientists are at liberty to take the data, examine it and come up with other conclusions, but we have not seen other scientists doing that and, moreover, we have not seen the NFU doing that, so it does come back to this question of what the scientific arguments are.

Q119 Chairman: Professor John Bourne, I think we interpolated, was somewhat frustrated that Defra appear not to be paying sufficient attention to his work. There certainly seemed to be a dearth of meetings between himself and the ISG and ministers, and he was quoted as being critical of Defra’s failure to incorporate the ISG’s suggested amendments into their badger culling consultation document. Against that particular background, do you think, from what you have read in the report, that there would be any basis, notwithstanding what is in it, for the Government to now come up with some kind of strategy to control bovine TB where culling played a part?

Dr Yarnell: Absolutely not.

Mr Booty: One of the strengths of the report is that, not only did it, as one would expect, report the results of the trial and analyse the results, but it then spent a section of the report applying the implications of what was found to a whole range of “what if” scenarios—what if badger culling was done this way, or that way, or the other way? All those are explored in depth in the report, the pros and cons of those are explored, and they explain why they come to the conclusion that it has no meaningful role.

Q120 Chairman: Even if, for example, somebody came along and said, “Look, I live in an area which entirely replicates the circumstances of the Irish trial—small area, self-contained, impermeable boundaries—and we have got a real problem on our farm. I want to do something about it. I want the right to apply for a licence to cull”, I do accept that this is a creative argument example for the sake of just discussing the point, but would you say that if somebody came along and said, “Look, that is the argument, I need to do something about it. I have ticked all the scientific boxes, it is exactly the same as what happened in Ireland”, would you still say that Defra should not consider a strategy that could involve culling, for example, under those circumstances?

Mr Booty: Shall I take first strike on that?

Q121 Chairman: By all means?

Mr Booty: I am always wary of hypotheticals, and I might resist your temptation. You referred to the Irish work. It is commonly referred to. I am referring to the four areas removal there. The geographical structure that was chosen for those with lochs and coastlines, et cetera, might start to fall within that sort of scenario that you were painting and, in those areas where there was not a natural boundary, they tried to complete the loop by having a six kilometre buffer zone, but, notwithstanding those natural boundaries and the buffer zone, they still had inward migration of badgers. There was a paper published in *The Veterinary Record* last November, reporting work carried out by two teams of researchers from Ireland, looking at the four counties results and looking at the different strain types that were found in the badgers removed during the trial. They found that the strain types within the badgers removed in subsequent removals were different from those in the initial removals and the researchers are interpreting that as evidence that there was inward migration of badgers into that area and that they were bringing the new strains of TB with them. So, in a sense, even in that scenario, however closely confined that was, there was still migration, there was still perturbation; it was not quite so neatly circumscribed as the hypothetical you posed to us.

Dr Yarnell: I think, in addition to that, the Irish study is flagged up quite a bit by pro-cull lobbyists. One of the problems with interpreting the results of the badger culling in Ireland is that there is an awful lot of improved cattle testing that has gone on alongside the cull, so it is very difficult to attribute the reductions they have had in TB over the last four or five years purely to badger culling. They simply do not know the level of the reduction in the disease that has been caused by badger culling as opposed to their improved testing regime. Trevor has written an extensive report on the Irish study. Maybe he would like to add a little bit further.

Mr Lawson: It is certainly the case that in recent years (and this goes back approximately five years now) the Irish have introduced a number of very rigorous cattle-based measures which, in large part, can explain that 40 odd per cent reduction, and further evidence of that comes from across the border in Northern Ireland where they had a similar level of TB and tightening up on cattle to cattle transmission has achieved a similar reduction without a badger culling strategy. The thing that we thought was most interesting in Ireland was that the greatest ever recorded increase of bovine TB in Ireland occurred between 1996 and 1999 from 27,000 to more than 45,000 reactors in three years. They were culling badgers throughout that period, but in 1996 they stopped pre-movement testing of cattle.

Q122 Chairman: So both of you are unequivocal that the strategy that Defra adopts now that the ISG has reported should be consistent with the results of their work. Is it something that, if Defra did produce

a strategy in which some form of culling was an element, that you would wish to challenge them in the courts?

Mr Booty: I think I might want to keep my powder dry as to what we may or may not do in terms of a potential challenge.

Q123 Chairman: So you have not ruled it out but you have not ruled it in?

Mr Booty: Well said.

Q124 Chairman: Would that be the same position?

Dr Yarnell: We would agree.

Q125 Chairman: Finally, before I bring David Drew in, you obviously have had a chance to think about the findings of the ISG report, and it may be that you still have more work to do; so let me ask this question in two parts. Are you, or when would you be, in a position to give a considered response to Defra by way of your observations and recommendations in the light of this final report as to what Defra now ought do? If you are able to help the Committee by giving us back some initial observations, that would be to our advantage.

Ms Robinson: I am happy to take that. I think, as Colin has pointed out, there is an awful lot to consider in the report, but we are very keen that the report actually provides a very useful basis to actually start looking at the possibilities in terms of a strategy of dealing with TB. In terms of our consideration and work on that front, we are going to look at it over the next month or so. We are obviously very wary of recess dates and things and people wanting comments and views as soon as possible, but we do hope to be able to contribute fairly shortly where we see a viable way forward.

Q126 Chairman: I was going to ask whether you had either heard from your contacts in Defra as to what their timetable of action was, or whether in fact you would prefer them not to make an announcement so that there was a period for proper reflection and discussion?

Ms Robinson: I think the latter is necessary. We have got a chance now to actually come up with some good proposals. I think any quick reaction to such a document would be quite foolish, and I think it is important now that all parties go away, think about this and actually look at what opportunities there are for the interested parties to work together, because there will be some areas where there is a need for collaborative work and opportunities for collaborative work.

Q127 Chairman: Dr Yarnell, do you want to respond on that?

Mr Lawson: Just picking up on that, one of the key things that comes out of this report—the badger culling question—is largely answered by ISG. That is done and dusted. Where there is uncertainty is which of the cattle-based measures are best implemented. That is the big question. Certainly the Badger Trust is not in a position to analyse the best of those from the point of view of which will deliver

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the most economic benefit, and that is what this debate ultimately comes down to. If the Government wishes to get on top of bovine tuberculosis it is which of the measures on offer gives it the biggest bang for the buck that is being paid out by the tax payer, and that requires some fairly robust analysis by Defra of the economics of that in partnership with the industry. What I would add is that this is not really new. Defra advised its partners in industry, back in December of last year, that the current TB testing regime was not sensitive enough to prevent the spread and movement between cattle. So, this has been on the cards for some time, and we would have liked to have seen further ground work done on that. Moreover, the predecessors of this Committee argued, virtually five years ago now, that there was concern in the absence of a plan B from Defra, and that is a concern for us too.

Chairman: Once again, we are ahead of our time but it is nice to do that. David Drew.

Q128 Mr Drew: We would like to hear the news about plan B. I would welcome your impression, because two of you, at least, were here on Monday to hear the four representatives of the ISG. What the ISG did in the session with us, and later in the Animal Welfare All Party Group, was to be very clear of what science they were willing to talk about and what they were not willing to talk about. Is there a real danger (and this, I think, applies to the NFU) that people pick the bits of science in the report that fit their agenda and the other bits, which are less satisfactory as far as they are concerned, they leave alone? I am worried that either the report is read as a whole—it is a detailed report and we are, all of us, trying to digest it—or, effectively, it is just one more piece of evidence which goes along with many other bits of evidence that we have had over many years. I would welcome your views on that, perhaps starting with Colin Booty.

Mr Booty: I think you used a phrase there towards the end, “Is it just another piece of evidence?”. There is a sort of exploratory view there. I think it is much, much more than that. It is the compilation of ten years’ work by a team set up for the purpose, and I think this should provide the bedrock on which policy is formed. There are other pieces of evidence, sure. Most of those complement the work that has been done. I was at the ISG’s open meeting yesterday, and I think Professor Woodroffe referred to some of the Irish work and saw the Irish studies as complementing their work, so not a conflict in that sense, but I would see this as the mainstay of policy formation, although I am aware that there are other pieces of research that are not yet finalised and in the public domain that were part of the associated programme of the work.

Dr Yarnell: This scientific report is quite clear to me. The badger side of the issue is dealt with quite clearly. The underlying problem with any badger control is the perturbation effect, and, as Professor Woodroffe mentioned to you on Monday, there is no getting away from that. So, we are at this position now where you are looking at a plan B, but there are things that can be done with the Wildlife Reservoir,

which Defra are investigating. For example, husbandry, reducing the contact rates at farm buildings, which I think is possibly quite a great transmission risk. Also in this report it states that, if we can start to control the TB in cattle, there is also a chance that the incidence and prevalence of TB within the Wildlife Reservoir itself will also be reduced. There is no timescale given to that, but that is something to look forward to in the future and possibly, if a vaccine is developed, that could be integrated into the strategy.

Q129 Mr Williams: Before the ISG report was produced there was considerable speculation in the press as to what Defra’s response would be, and, indeed, there was a suggestion that the Secretary of State had written to his fellow Cabinet members, indicating that there may be progress towards larger area culls. What was your reaction to those press speculations?

Ms Robinson: I think the critical thing is that was then. It was alleged that a letter was sent. We are certainly unaware of any kind of letter. We had not seen anything. I also understand that there were discussions about quite what was in the alleged letter, possibly even looking at certain options rather than just one view or another, but I think the critical thing is that we now actually have the sound science that Defra has asked for and I think the way to move forward is to use the ISG report as a basis, and, obviously, Defra will have to discuss with Cabinet colleagues, with other ministers and work out a way forward on that basis.

Q130 Mr Williams: Do you want to say anything?

Mr Lawson: We noted that *The Sunday Times* did not say that it had seen the letter, which we thought was interesting, but the curious thing for me was that the letter quoted a figure of 100 square kilometres for culling as making a difference. John Bourne mentioned to you on Monday that that was in the Government’s consultation in 2005, but the ISG has rejected that and made it clear that it was at least 300 square kilometres in early 2006. I have to say that we felt it very unlikely that the Minister would be arguing that culling over 100 square kilometres would be effective when it had been rejected more than a year ago by the scientific advisers.

Q131 Mr Williams: Would you agree that science is never complete and that actually the scientific method is about achieving results, then developing another hypothesis and conducting further experiments to test that hypothesis? To say that this is the complete science is not a proper scientific approach?

Mr Booty: There is always more research to be done, there are always more questions to answer, so in that sense there is always more science to be done. I think, the ISG has successfully undertaken and completed what they were charged with doing and from the outset, from our first interactions with Professor Bourne and the ISG team, we as an organisation were impressed by the approach that they were taking to this problem, not only in the

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badger culling trial but looking at the problem in its broader perspective. They were going to investigate the cattle disease aspects as well, a wide range of things, so they were not going to take the narrow remit of just overseeing a culling trial and seeing whether it did or did not do certain things, and that approach applied. I suspect that some of the people at the ISG themselves would say there is more work to be done, but this now gives a sound basis on which to base some policy.

Q132 Mr Williams: I think Dr Yarnell said that the real problem with culling as an integrated approach to dealing with bovine TB is perturbation, the edge effect, and that the evidence from proactive culling is that actually you get an increased reduction of breakdowns and reactors as the process goes on, and, of course, the bigger the area the lesser the edge effect and the less perturbation in proportion to the area that you are culling. Would you not say that that leads you to the premise that actually increasing the size of the culling gives you a better effect and less problems with perturbation?

Mr Booty: As I mentioned earlier, one of the strengths of part of this report is that it looks at other badger culling scenarios, not just the ones that were operated during the trial, and one of those scenarios was: what if the area was big? What if it was 300 square kilometres? Yes, in certain respects, the bigger area proportionately the smaller circumference you have and proportionately the smaller edge. It is still a big edge, there are still a lot of neighbouring farmers to that edge that might be affected, but the larger the area the more your practical and logistical problems of—

Q133 Mr Williams: But that is not a scientific problem, that is a practical problem.

Mr Booty: No.

Q134 Mr Williams: So, looking at the science, would you agree that that hypothesis is worthy of investigation?

Mr Booty: The ISG takes the view that that is not worthy of consideration.

Q135 Mr Williams: For practical reasons.

Mr Lawson: Do you mean a scientific investigation?

Q136 Mr Williams: Or a practical test, or whatever.

Mr Lawson: Presumably that would be another scientific experiment. Let us draw the logical conclusion out from that. If you look at the bovine TB area, a couple of years ago Mr Bradshaw said in Parliament that within about one and a half kilometres of TB infected farms at that stage, if you added up that land area, it was in excess of 25,000 square kilometres. So, you cannot just do a bit, you cannot say, "Let us just do the first 300 square kilometres." What is clear about the science is that you have to do the whole lot in one hit and you have to do it consistently. Even from a scientific point of view, it is significant because of the resource implications. Science does not operate solely in a vacuum. The other difficulty with that is that the

areas were selected and the research was undertaken in so far as it was practicable. We know that in some areas there was less landowner co-operation than in others, but, of course, as you go beyond that, you are going to encounter large areas where culling is not possible, so the edge effect within the culling area, as well as outside it, could also be exceeded to the point where the negative effects are so much greater. So, you need to take all of that into account. It is very difficult. I think it is wrong-headed, if you like, to say that if the world was different, if the landscape of the West Country and Western England was different, would this work? It may well do. But even if you take into account the simple modelling of the ISG, you would only be dealing with 30% of the problem, and, again, if you come back to the economic argument, which is what the political argument is all about, "How are we going to get the most bang for the buck?", it is quite clearly going to be on cattle.

Q137 Chairman: The south-west of England is contained on two sides by sea, so you could surely run a bit of a trial by delineating part of that, could you not?

Mr Lawson: What, the whole of it, or just putting a line halfway down the West Country?

Q138 Chairman: Depending on how many square kilometres you wanted to have as a trial to try out the large-scale effect which the ISG report says does actually have some beneficial outcome, you could draw your line moving, if you like, from Lands End upwards, where it was practical so to do.

Mr Lawson: I am sure Professor Christl Donnelly could give you more on this, but you have to bear in mind that one area is not a very effective scientific trial. The strength of the ISG's work was that it was a large-scale randomised culling trial. As you pointed out earlier, the Irish selected areas because they had boundaries.

Q139 Chairman: We are going to talk about Ireland in detail in a moment.

Mr Lawson: That suggests that what is going on in the rest of Ireland is not going to be what they found in those areas, so you generate problems of your own. Do not forget that TB does not stop in the West Country; it carries on up the west coast. It goes up into Shropshire, it goes into Staffordshire, it goes into Derbyshire and it is down in Pembrokeshire, so you would be sectioning off a very large part of the country if you were looking round that route as a practical solution to bovine TB control, and, of course, there is Sussex.

Chairman: There are many that do not see it spreading further than that, but I am sure we will hear from them fairly shortly. David Taylor.

Q140 David Taylor: Political parties have spin doctors and pressure groups have media advisers. In your battery of responsibilities there will no doubt be one involving the drafting, approval and distribution of press releases. Would that be true?

Mr Lawson: Yes, that is right.

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Q141 David Taylor: I do not know if you recall one less than three weeks ago which seemed to reveal that you do not think much of the State Veterinary Service. Would that be true?

Mr Lawson: I will qualify that. We looked at the State Veterinary Service because we noticed in recent weeks very public statements by officers of the State Veterinary Service claiming that they knew what the problem was, in others words badgers, that they knew how to deal with it and that they were frustrated at being unable to deal with that. We have noted that this has been a trend for some time, as our report makes clear, but we looked in detail at what the SVS was saying and whether or not the claims that state vets were making were supported by the facts at their disposal, and we found that they were not. I would clarify our position by saying that we do not have a problem with the SVS, or Animal Health as it stands *per se*, because it has long been an under-resourced organisation which has suffered problems as a result, but we do feel that at that level they were insufficiently qualified to make the claims that they were making.

Q142 David Taylor: It was not just 'for some time', though, was it, your remarks were a bit more long term? You are too young to be familiar with the Queen in Lewis Carroll: verdict first, trial later. That is what you are really saying about the State Veterinary Service, are you not? You said that many of them have devoted their careers to, and stake their reputations on, blaming badgers. They were your words, were they not?

Mr Lawson: That is the case.

Q143 David Taylor: So, it is more than just in recent times. You believe that they have been of that opinion for a very long time?

Mr Lawson: Yes, and I might add that the predecessor of this Committee was critical of the State Veterinary Service for its failure to use a scientific approach in analysing the problem.

Q144 David Taylor: There are not too many common people on both Committees, I do not think, but you went on in that press release to paint a fairly bleak picture of the Minister. You said that he would be in a science vacuum at the mercy of state vets, as if he is some poor, simple sap baffled by scientists with a hidden agenda. That seems to be the underlying theme of that press release, does it not?

Mr Lawson: We were concerned about the lack of scientific rigour as applied within the State Veterinary Service. I might add that we are not the only ones to have expressed concern about that. The Science Advisory Council at Defra has also expressed concern about that.

Q145 David Taylor: I will come on to that in a minute. Okay, in seven days time, or whenever it is, the ISG will be no more. That is the scenario you were looking forward to, was it not? You were suggesting that there would be particular difficulties

for the animal welfare minister at that point. Could you go into a little bit more detail as to what difficulties you anticipate?

Mr Lawson: Sure. We have been aware for some time within the State Veterinary Service at a senior level of the Minister being advised that the veterinary advice is to deal with the root cause of the problem by removing it. That was the major justification for badger culling. That position has not changed. The state vets at a senior level are still arguing that, both on a regional basis and on a national basis.

Q146 David Taylor: So you think that, after the ISG have gone over the horizon, the state vets will be arm-twisting the Minister back to their point of view. Is that what you are suggesting?

Mr Lawson: The Science Advisory Council, because, do not forget, we take this whole picture into account—

Q147 David Taylor: What is your own view? We will come to the Defra Science Advisory Council in a moment. What specifically do you feel or in what ways will the Minister be vulnerable to this type of deal in smoke-filled rooms, as it were?

Mr Lawson: For example, proposals which would suggest that a different kind of culling regime might yield results, not identified by the ISG. I have to say that since we wrote that report, we did not know at that stage that the ISG was going to be so thorough in addressing the full range of culling options. One of the things that we were involved in, in 2005, was the citizen's panels which Defra ran, where I sat alongside Meurig Raymond from the NFU and two representatives from the State Veterinary Service, and one of the things that was of interest there was that the state vets were making it very clear to the members of the public there that, for example, the badger culling in the trial was inefficient, only 20 to 60% of badgers culled. That was what the state vets were telling members of the public at that event. That has since been shown to be factually inaccurate, but that was a very serious cause for concern to us.

Q148 David Taylor: Now that the ISG report is out, you are still not reassured that the bleak picture that you have predicted is less likely to take place, are you?

Mr Lawson: Because the scientific advice has analysed all those possible culling scenarios.

Q149 David Taylor: So it is not as bad as you predicted 20 days ago?

Mr Lawson: That is right.

Q150 David Taylor: To come back to the point you were trying to make when I interrupted you (and I am sorry about that) the Defra Science Advisory Council has agreed with you to an extent by saying that the Government should have established a bovine TB science advisory body rather earlier. That is not going to be available until 2008. Do you think that Professor Bourne and his team should be put on

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life-support until 2008, until that body exists? You did not want the ISG to be closed down at the moment. You have said that you wanted a bovine TB science advisory body to be set up. Would that be a way of bridging the concerns you have got?

Mr Lawson: There are two issues there. First of all, we think that the Government needs to have continued broad spectrum scientific advice and how the Government goes about that is its decision. Whether the ISG would want to continue doing so is hard to say, but it is not exactly either what the Science Advisory Council has requested. The SAC has requested a more broad-brush approach that focuses on the bacterium itself. That was not the ISG's role. The ISG's role was far more specific than that with relation to badgers and bovine TB.

Q151 David Taylor: In your view, but not theirs, would the continuation of the life of the ISG be desirable in the absence of the science advisory body that you refer to?

Mr Lawson: I would think so, in the absence of that, but I do not see why it should take until 2008 to formulate a science advisory body. This has been on the cards for over a year already. There is no obvious reason for it to be taking that length of time, other than a lack of interest in Defra for establishing it.

Q152 David Taylor: Mr Booty, you look as if you want to say something.

Mr Booty: Yes, if I may, I was going to pick up on that point, because the way your questioning was going, I was wondering whether we needed to accept the presumption that this new strand of independent scientific advice need not come on stream until 2008. There have been a number of years' discussions between the Science Advisory Council and Defra, so the question might need to be asked, why do these need to be prolonged for another six months? At yesterday's ISG open meeting, in the margins to that, I was speaking to Professor Gaskell, who is the Chairman of the TB Sub Group of the SAC, about what they saw as important, and they do see it as important, as it being a single strand of independent science advice on the TB issue going into Defra; and I questioned him in relation to Peter Jinman's TB Advisory Group and he said he has had discussions with him and he sees it being quite distinct. The TB Advisory Group, which is already in existence, is considered to have much more liaison with stakeholders and a policy implementation role, not as a strand of independent scientific advice, and it is how Defra gets hold of that. They were airing these issues in one of the many consultation documents that have come out of Defra in recent years. So, I think we go back to the point: what is magic about 2008?

Q153 David Taylor: You still remain concerned that the pro-cullers will identify some amenable independent advisers who will then whisper in the Minister's ear in the absence of an equivalent to the ISG?

Mr Lawson: I would say that is a very genuine concern based on our interactions with that part of Defra up until now.

Q154 Sir Peter Soulsby: I was interested in what you said about the Irish experience and the decline in the number of reactors from 1998 through to 2006. The Irish Minister of Agriculture and Food takes a very different view as to the reasoning behind that drop. Why is she wrong?

Mr Lawson: Briefly, there are two parts to the Irish question. That is probably not the best way of describing it, but you know what I mean. There is the Four Areas Study, which was a scientific experiment which, if you look at the ISG's report in detail, raises some questions about the conclusions of that in terms of how the research here suggests that the results might have been exaggerated. Alongside that is the wider question of TB control policy in Ireland and how it has changed over the years. In *Veterinary Microbiology* there was an interesting paper, published in the wake of the International TB Conference held in Ireland by Professor Simon More and Margaret Good from Ireland, where they looked in detail at the history of TB policy in Ireland. What that showed was a range of different measures. It showed that they had been culling badgers for 20 years at various levels and the ISG's research here, compared to the Four Areas Study, showed that when the science started they had very low levels of badgers in terms of population density compared to Britain. But what it also showed that when, as I said earlier, they abandoned pre-movement testing in 1996, TB went right up. It then gets a little bit sketchy towards the latter end of the timeline as it is shown (and it is harder to tell, and we have not been able to find any figures on this as yet, only a general statement from the Minister) to what extent additional measures, including gamma interferon, tighter controls on farms under TB restriction, restrictions on animal movement, various restrictions in terms of across the border, and so on, have had an effect; but I can recall an interview with Margaret Good from the department in 2003 on Radio Four saying that they had had very significant benefits as a result of using gamma interferon, and that is the problem. The NFU has referred to the Irish success, but that does encompass (when they talk about those figures) that period when the Irish were doing a great deal of cattle-based TB measures. In addition, a report from the University of Reading for Defra published in 2005 made it clear that in Northern Ireland they had a major reduction in bovine TB of 40% in one calendar year by focusing on cattle-based measures, particularly with the roll-out of gamma interferon and clamping down on farms under TB restriction.

Q155 Sir Peter Soulsby: Looking at the Minister's own views on this, she said, not just that there were a number of factors, but that her department was satisfied that the badger removal policy made a significant contribution to the improvement of the situation. You are saying that she is totally mistaken, are you?

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Mr Lawson: Well, we are of the view that the view expressed by the Minister is influenced as much by the politics of the situation as the science, and one of the reasons for that is that—. Let me give you an example. In Ireland the view now is that badgers roam very widely, in areas in excess of 15 kilometres, on a regular basis. It is a bit like what happens when you have the perturbation effect here. As you reduce badger population density, the animals roam more widely. So you have got a wide-roaming badger population, which, according to the Irish Government, is responsible, in very large part, to the problem of TB in Ireland. They are the majority factor, it appears. Yet, when you look at bovine TB in cattle by strain type, it is very tightly clustered. Those two facts do not add up, do they? If you have got badgers roaming widely and, supposedly, spreading the disease over very long distances, why is TB very tightly clustered in cattle herds? Another problem we found with the Irish data is that during the 1990s the average level of bovine TB identified in badgers was 12.8%. In the Minister's statement I think you will find it has gone up to 40% now. In other documents we have seen it is described as in the order of 20%—in statements by the Minister—so there is that significant variation in the definition of what proportion of badgers are infected with TB, so there is another problem there. Finally, picking up on that issue, the assumption that because there is X percentage of TB in the badger population that indicates that they are the agents, in other words more TB in the population means that they are spreading it at a greater rate, is not necessarily the case, because in epidemiological modelling being susceptible to TB is not the same as being infectious with it. Certainly what we do not see in Ireland are clear statements about the infectivity level of badgers in Ireland. There are lots of figures about the supposed level of infection within badgers, but not the extent to which they are supposedly infectious.

Sir Peter Soulsby: Thank you, Chairman. I think I will leave it there, because no doubt the NFU have been listening to that—

Chairman: I can see they have.

Q156 Sir Peter Soulsby:—and I will be interested to hear their perspective on that later on.

Chairman: Sitting where I am, I can see the body language of the audience, so I can see we are in for an interesting session. I would like to move on, Roger, please.

Q157 Mr Williams: Thank you, Chairman. Could I just ask the RSPCA about your assessment of TB in badgers, in terms of the percentage of the population that have it, but also in terms of the effect that it has on badgers themselves in terms of their general health and well-being?

Mr Booty: The percentage of the badger population that will be infected with TB obviously varies from area to area. I think the figures from within the badgers that were removed in the culling trial varied between of the order of about 4% up to about 40%, so there is obviously a range within that. Within the Road Traffic Accident Study that was undertaken, I

think the average figure was that about 12% were infected. Of the badger population that is infected, a relatively small percentage will go on to develop acute clinical signs of the disease in which they will be perhaps emaciated, have severe lesions et cetera. In that handful of animals, perhaps, yes, there will be a degree of suffering, if that is, I suspect, where you were endeavouring to go to.

Q158 Mr Williams: But if you say there is 12% or 15%, how many badgers is that? What is your estimate of the badger population?

Mr Booty: That is one of the \$64,000 questions in this equation.

Q159 Mr Williams: You say there will be a handful of badgers that will suffer serious effects from TB?

Mr Booty: Yes.

Q160 Mr Williams: Can you put a number on a handful?

Mr Booty: No, my recollection is that something of the order of 1 or 2% might go on—

Q161 Mr Williams: How many badgers. It is very easy to talk in percentages, but are we talking about 50,000 badgers having serious effects of TB?

Mr Booty: No, you are probably talking about a matter of hundreds.

Q162 Mr Williams: So more than 100?

Mr Booty: Probably in that region. Why I said it was one of the \$64,000 questions in this equation is because the last national badger survey that was undertaken was over ten years ago, so there is no current baseline data to inform that part of your question. There is a range of estimates that are put out that are between 300,000 and 400,000—it is in that sort of area—and the population in some areas has shown signs of increase, in some areas has shown signs of stability.

Q163 Mr Williams: Anecdotally people would say the badger population is increasing rapidly, but you do not believe that that is the case?

Dr Yarnell: The long-term studies have very accurate data on publishing dynamics of badgers. In the Woodchester Park study, which I am sure you are all aware of, the population did increase in the 1990s, it plateaued off around 2000 and I believe that now the population is actually starting to decrease, and I believe they are going to publish that data shortly. It is very difficult to know what is happening with the badger population. There is a lot of anecdotal evidence and a feeling of what is happening based on what people see on the roads and so on, but it does not correlate very well to actual numbers.

Q164 Mr Williams: The behaviour of badgers visiting cattle sheds, for instance, is a relatively new phenomenon, or not? Some people would say the increase in the badger population is forcing badgers into positions and territory that they have not taken up before.

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Mr Lawson: It is new in the sense that it has been filmed for the first time. What was curious about that research at Woodchester Park is that the farmers, when they were asked by the scientists, said that they did not think badgers were getting into their buildings, and when they were shown the footage they said, "My goodness." They had no idea what was going on on the ground. On the issue of population, let us be clear about one thing, there are two factors that are going to govern badger population dynamics in the round. The major one is habitat availability. Unless there are major shifts in habitat availability in the countryside as a result of major changes in agricultural practice, then populations will remain largely stable, unless you cull them or some other large scale element from outside, say, for example, climate change leading to more prolonged, dry summers having a negative impact on badger reproduction, but even then wildlife will compensate and take advantage of the habitat to the maximum by breeding faster; so it is unlikely that there is a major shift in that regard. We have seen figures banded around of badger populations in excess of one million, then it goes up to two million the next week and three million the next week, but on average the overall figures coming in are around 300,000 to 350,000. Can I just add, on this issue of how many badgers are ill with bovine TB, when you look at the ISG's data one of the other things that that makes clear is that TB varies enormously in terms of its intensity in both time and space, and so badgers in one area may have higher levels of TB than in others but that is not consistent over time, so you could not look at an area of the country with any degree of accuracy and specify whether three badgers or ten badgers in that thousand square kilometres had TB at that time.

Q165 Mr Williams: Do you believe that bovine TB in badgers is an animal welfare issue and, if it is, do you think there should be any priority for developing a vaccine to deal with that animal welfare issue?

Mr Booty: There are two related elements to that question. I will take the first one first and come back to the vaccine. Generally speaking, we take the view that TB in badgers is not a significant animal welfare issue. Society at large (and I do not mean just our society but it was a point that came out in one of the Defra consultations on the wider animal health and welfare strategy) takes the view that disease in wildlife is part and parcel of wildlife, it is one of the challenges and one of the drivers behind what causes species to evolve. Society does not get involved with wild animals that have many diseases intrinsically. There is, particularly from our perspective, a nasty little parasite that burrows away into the nasal cavity and brains of stoats and weasels, but there is not an animal welfare strategy to deal with that parasite that has that effect on stoats and weasels. Society becomes involved with disease in wildlife really for two reasons. One is because it has a zoonotic effect. In the case of badgers it is having implications into cattle disease and, potentially perhaps, human disease. The other scenario is where

a wildlife disease is having a biodiversity impact, something like the squirrel pox virus. Those are the situations, not usually because of disease *per se* in the wild animal. The other element of your question was about a vaccine.

Q166 Mr Williams: For badgers?

Mr Booty: I think for badgers, yes, but not just from the perspective that it would be good for badgers. I think, broadening it out, ultimately a vaccine may help provide a solution for this problem. It is the approach that is being developed and researched in New Zealand, it is also the route that the teams in Ireland are investigating and it is also a route that is being investigated in this country and, fortunately, there is collaboration between the various parties and I think that ultimately is the route that we need to go down. I am aware not only that the Chairman is watching the clock, or whatever, but that one must be wary about making simplistic comparisons, but if you consider the situation with the rabies virus in Europe, where for many years the problem of wildlife rabies occurred and it was attempted to be dealt with by a slaughter policy of various species of wildlife on the Continent, that singularly failed to address the spread of rabies and it was not until an oral bait was developed to deal with it that we have seen a dramatic decline in the incidence of rabies throughout the European mainland?

Chairman: Mr Drew had a question on wildlife.

Q167 Mr Drew: Again the problem is, and this is one of the difficulties, in a sense we are obsessed with bovine TB in badgers, but, of course, bovine TB is carried by a number of species, particularly roe deer. I know you do not like hypotheticals, but if we were to see domestic animals become more subjected to bovine TB, which would then have an impact on the human species, would that change your mind? I know that is a difficult one for you to say yes or no to, but there are reasonable scenarios out there if the spread of bovine TB was to carry on uninhibited?

Mr Booty: If I can take the element: does the spread of bovine TB cause us concern? Yes, of course it causes us concern, but I think what follows from that is how does one effectively address that spread of TB, and that is where we wish to get to; so action that would effectively prevent that spread is where we need to be.

Q168 Patrick Hall: There has been speculation about possibly the effect of a Government decision not to cull. In fact, as long ago as December 2005 the Deputy Chairman of the ISG, Professor Donnelly, was reported as saying that if the Government banned badger culling it could end up with a serious problem of patchy, illegal culling. As we all know, the badger is a protected animal species and there are possible criminal sanctions, including imprisonment, if someone is found guilty of an offence. I am glad to see that Mr Raymond, the Deputy NFU President, said last October that some badger culling was already taking place in certain parts of the country by desperate people. Could I ask the two organisations before us now, does illegal

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badger culling take place and, if so, would a ban put the pressure on to increase that and, if so, what should be done to tackle that? Maybe Mr Booty could start.

Mr Booty: In relation to your question about patchy, illegal culling, the evidence that we have before us shows that organised legal culling can make matters worse, and, therefore, it follows from that that anything less than that in terms of patchiness or illegality is likely to make a situation worse rather than better. One can certainly sympathise and understand the concerns of farmers, we are not unsympathetic to farmers, who are in a mess on this, but what I think has not been well undertaken so far is the translation of the sort of science that is coming out of this work. What is this perturbation? What does that involve? What are the implications for that? I think that needs to be more clearly and concisely conveyed.

Q169 Chairman: Can we just come back to the question that was asked instead of having a lecture on perturbation?

Mr Booty: I am sorry, my train of thought wandered from where it started.

Q170 Chairman: You perturbed. Can you come back now to the question Mr Hall asked you. Have you got any evidence that any illegal culling has been going on?

Mr Booty: The RSPCA routinely, throughout the course of the year, receives a number of complaints about illegal badger activity and persecution. It is always, in whatever field of endeavour you are talking about, difficult to judge how much illegal activity is going on? How much of the iceberg are you picking up?

Q171 Chairman: Simply, the answer is you have had some complaints but you have got no evidence?

Ms Robinson: In terms of illegal badger culling or just general complaints about badger—

Chairman: Illegal badger culling.

Q172 Patrick Hall: The question is illegal badger culling. You are an organisation that would be at the centre, I guess, of hearing about this and may in fact prosecute.

Mr Booty: The RSPCA regularly undertakes prosecutions of those involved in illegal badger digging and illegal badger baiting. That has been the case for a number of years. There are not a large number of cases each year, but there are a steady number of cases.

Q173 Mr Gray: Those people that are allegedly badger baiting, that is quite different?

Mr Booty: Yes, I said badger digging and badger baiting.

Q174 Mr Gray: That is quite a different thing, a different group of people.

Mr Booty: Oh yes.

Q175 Chairman: Before we get into too much speculation, the short answer is you do something, but you have not got any specific examples of what Mr Hall was asking you about?

Ms Robinson: I am not aware of any cases having been reported.

Q176 Chairman: So the answer is no. That is very good. What about the Badger Trust? Have you got any proof that there has been illegal badger culling going on? It is yes or no. Have you got any?

Mr Lawson: Can I raise the issue of the definition of “illegal”, and it is an important issue, because the protection of badgers—

Q177 Chairman: Let me put it in rather more layman’s language. What we are talking about is people going out with various forms of firearm on their farm and doing whatever they want to do to badgers: shooting and killing them to put it in straight language.

Mr Lawson: There have been documented cases of this behaviour taking place, on occasion broadcast by the individuals involved on the media, and the question has arisen: should they be prosecuted? Our understanding of the issue is that it poses a difficult area for the Crown Prosecution Service insofar as there is—

Q178 Chairman: Before we get into the Crown Prosecution Service, I think Mr Hall was interested to know if anything had been going on. We will worry about prosecution at another time. We are trying to get an idea if there are a lot of people going out and doing DIY culls?

Mr Lawson: I think the short answer to that is that we do not know.

Chairman: Fine. Mr Hall, back to you.

Q179 Patrick Hall: We will move on then, because if you have not got any evidence, or if the NFU seems to think it has been going on, the question was, would a total ban increase the pressure for illegal activity, but you have left that hanging in the air, which is entirely up to you. Could I turn to another matter? Mr Booty, you said a few minutes ago that the issue that we are talking about today is not a significant animal welfare issue, and that was, I think, with regard to the badger; but is this not, in fact, an animal welfare issue, certainly with regard to cattle, I would have thought perhaps badgers too, but maybe there is a different definition because some are wild and others are domesticated animals. Certainly the NFU seems to have a view about the RSPCA’s position on this. There has been a recent comment from the Director of Communications saying, with regard to the RSPCA, that in resisting action to deal with the disease in wildlife, the RSPCA was turning a blind eye to the welfare of tens of thousands of cattle that are either slaughtered prematurely each year because of TB or which are subject to near intolerable levels of stress caused by almost continual testing. How should we fairly balance the animal welfare issues that legitimately arise in this difficult question?

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Mr Booty: I think, in terms of animal welfare, my colleagues in the Society's farm animal welfare department would rank much higher up the scale of animal welfare issues problems such as lameness and mastitis, which affect a far larger number of cattle and have a far greater welfare impact. In terms of the cattle that are slaughtered, et cetera, the question of whether that slaughter is premature or not is not in itself an animal welfare issue because the slaughter will be undertaken humanely, so the slaughter itself is not a welfare issue. There may be welfare issues associated with the consequences of the restrictions on the farmer's operations, that perhaps he will have to retain more stock for longer, et cetera, problems with sufficient feedstuffs, et cetera, those sorts of miscellaneous consequences on how they operate their farming business, but in terms of direct cattle welfare, no, my colleagues in the farm animals department do not believe that it is a significant cattle welfare problem itself. It is not as if the disease is progressing in the cattle to a clinical state. The testing mechanism is endeavouring to pick it up in the earlier stages.

Ms Robinson: To come in on the end of that, I think Colin has hit the nail on the head there. In terms of welfare, if you are looking at culling strategies or how you deal with animals that are potentially infected, in terms of the cattle it is in a very controlled environment, it is done with somebody who is competent at humanely dispatching cattle. With regard to a possible cull of badgers, obviously in the trials you have had skilled, trained people who did it humanely; whereas the concern for us in terms of welfare of the badgers and any possible cull is that there have been rumours that they might not necessarily be the same kind of trained people, but it is a real dilemma in terms of balancing cattle welfare against badger welfare.

Q180 Patrick Hall: I must say, I am fascinated by what seems to be a different definition of animal welfare to what maybe the general public would understand it to be. There is nothing wrong with there being different definitions, and it is your full-time concern, but the idea that if an animal has a foreshortened life because it has a disease but as long as it is dispatched humanely that is not an animal welfare issue is an interesting issue. Perhaps there is not time to go down that road, but I do find it quite fascinating—

Mr Booty: My colleague in our farm animal department will be pleased to discuss it with you.

Q181 Patrick Hall: —that the RSPCA does not see this issue as fundamentally an animal welfare issue or at least include significant animal welfare implications. What does the Badger Trust think about that?

Mr Lawson: I will make a couple of observations. On the issue of cattle welfare, the Government had a report published last year on TB testing and it made the interesting observation from vets that the current trend in terms of breeds towards crossbreeds, continental crossbreeds, is posing difficulties in terms of doing the skin-test itself because those

animals are particularly difficult to manage in a testing environment—they thrash about and kick about a lot and get pretty stressed out by the experience. One of the benefits of gamma interferon testing that has been mooted is that it is a quicker blood test that only requires one visit from the vet and does not require you to put those livestock through the pen twice. That has to be balanced by the fact that the scientific advice shows that the skin-test and gamma interferon work best used together; so that may not be a great benefit. Can I just add one other thing in relation to your question about illegal badger culling. One of the things I wanted to add on that, if you look at Defra's map of bovine TB, it is a small-scale map where you see the whole country and there is a big blob of red over the West Country and up the west coast, but when you go down to the macro level and you look at the distribution of bovine TB at a local level, generally there is relatively modest clustering in terms of infected herds, and when you look at parishes you get large areas where there is no TB. In other words, in a parish only maybe, at a maximum, say, 35% of the herds may be affected, and one of the difficulties is, if you have got 35% of the herds in a parish affected and the farmers on those are culling badgers, you are creating, in effect, a perturbation effect on the macro level that puts their neighbours at risk. Our view is that the NFU should seize on the scientific research that has been published and make it absolutely clear to its members that that is the worse thing that they could possibly be doing for their neighbours as well as for the farming community as a whole.

Q182 Patrick Hall: That last comment was about the previous question, which is on the record, and maybe that will help you discuss things with the NFU, but can I, therefore, conclude on the relative merits or otherwise of animal welfare considerations that both of you disagree with the NFU's view, which seems to be that you are both more concerned about the welfare of badgers than of cattle. You are both saying that it is not an animal welfare issue full stop.

Mr Booty: It would be a wrong impression to say we are not concerned, that our concern is solely related to the badgers in the context of your question and the disease and the consequences. We see the consequence primarily as not being a major animal welfare issue. That is not to say that we are not concerned, as I sense might be interpreted, about farm animal welfare.

Patrick Hall: That seems to be what the NFU has said, but we will have the opportunity to find out this afternoon.

Chairman: I am going to bring matters to a conclusion, because I think we have listened very carefully to both the Badger Trust and the RSPCA and we are very grateful to you for your contribution and observations. I suspect that the Committee's work in this area will not be concluded quite as quickly as we had thought and, therefore, that gives you an opportunity, during your period of further reflection, if there is anything else that you wanted to communicate to us to assist us in our further work,

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we would, as always, be delighted to hear from you, but can I thank you for your observations this afternoon. It has been very interesting to hear from

you and I am now going to invite you, if you would be kind enough, to vacate the witness stand and we will hear from the National Farmers' Union. Thank you very much.

Witnesses: **Mr Meurig Raymond**, Deputy President, **Mr Jan Rowe**, Bovine TB Spokesman, **Mr Martin Haworth**, Director of Policy, and **Ms Catherine McLaughlin**, Animal Health and Welfare Adviser, National Farmers' Union, and **Professor Rosie Woodroffe**, gave evidence.

Chairman: Can I welcome representatives of the National Farmers' Union to the second half of our evidence session. As always, we are terribly optimistic about when things are going to start; we are less clear about when they are going to finish. We have spent a little bit longer on the first session than we planned to. Nonetheless, I think it was important to hear from those two organisations, just as it is now important to hear from farmers' representatives. We particularly welcome Meurig Raymond, the Deputy President of the Union, Jan Rowe, who is their Bovine TB Spokesman, Martin Haworth, their Director of Policy and Catherine McLaughlin, their Animal Health and Welfare Adviser. I am going to ask David Drew if he would be kind enough to commence our questioning.

Q183 Mr Drew: Monday's report must have been devastating news for yourselves. Obviously, there was a degree of spinning in advance of the final report of the ISG, but it did not help your perspective in that you wanted some clarity in your well-known position that badger culling is an effective tool in trying to reduce the level of bovine TB; and I know there is an argument that you could still look at this idea of a very large-scale cull but certainly in the later meetings that the ISG attended they seemed to pretty well deal with that in terms of the issue of the perturbation effects in the area around. How do you respond to the ISG now, how do you see some of the science and what is the way forward for the NFU?

Mr Raymond: Can I also point out that our President, Mr Peter Kendall, is sitting at the back, so this is an important issue for us. Yes, we were extremely disappointed, I have to say, with the report and surprised as well, particularly as far as the culling aspect is concerned. When you think back over the last couple of weeks, and I have been involved in discussions with officials, with ministers, and I do not need to say that there were articles in *The Sunday Times* and, I believe, in *The Daily Telegraph* leading up to the release of the report, we were extremely surprised when the report was made public. I have to say, we believe that that final report was very slanted. It was particularly slanted towards cattle measures and against a badger cull. It is obviously a 300-page document. We are analysing that document within house. It is going to take some time. There are some positive statements, I have to say. I think it is recognised as a statement by the Chairman of the ISG, where he does state that badgers do play a significant part in the spread of bovine TB in the cattle herd, so there are statements

in that report, but I think we can actually carry on the debate, carry on the argument. Where do we go from here? We analyse, we argue the point on perturbation, we can argue the point on some of the detail. It is a scientific document and we have got to look at the practicalities from here forward.

Q184 Mr Drew: In terms of the actual science, obviously Anthony Gibson has had some points to make in general, but are there already specific points on which you would question the ISG in terms of their scientific rationale?

Mr Raymond: I get extremely confused, as I said yesterday at the presentation, because it was only about six weeks ago that I went along to the Annual TB Conference where I listened to a scientific paper put by Professor Simon More of Dublin University, and that does come up with a totally different scenario to the one we heard yesterday. Are we critical? We could question the argument around perturbation; we could question the issue around incidence in cattle herds. I think John Bourne did admit yesterday that up to 40% of the spread of the disease in the cattle herd is from the badger population, and there was a question yesterday on the reinfection of cattle herds, particularly in the hotspot area and did he have any evidence to prove that this was from the cattle population or was it from the wildlife population, and he did not have an answer to that. So, there are plenty of areas we can question. Martin.

Mr Haworth: I do not think we are in a position to question the scientific evidence that has been presented, but I think there are two points to make. One is that this was a scientific evaluation of trials that themselves may have been flawed. It may be correct conclusions drawn from trials which were inherently flawed themselves, so that would be one level of questioning one would put about the report. The other is, to go back to what Meurig said at the beginning, the actual presentation of the report seems deliberately slanted against a cull and, to take the question of perturbation, the report is at pains, in many cases, to emphasise the importance of cattle movements as the means of transmission and to downplay badgers as a means of transmission. Indeed, their final conclusion is that a badger cull has no part to play in the strategy and yet, when they talk about culling, their argument against it is that it causes perturbation. Perturbation is a prime example of a disease transmission from badgers to cattle, and so, when it suits their purpose, they emphasise the importance of badger transmission, when it does not suit their purpose they do the

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opposite. So, I think that is an example of, not necessarily the science being wrong, but the presentation of this report, as Meurig said, being slanted.

Mr Rowe: Coming back to the science and really picking up Martin's point, I think what we have learnt is a huge amount of detail about a method of trapping that, even after year-two of the trials, Defra said would never ever be used. What we learned right from the beginning of the trials and now real evidence is that if you are going to trap badgers, cull badgers, it has to be done in a much more efficient cost-effective way than was actually done in the trial. Having set out at the beginning cage trapping as their method, they were left with nothing else to do. I think our criticism of it is not so much about the science drawn from what they did but about actually what they did in the first place, which was to use a very cumbersome—

Q185 Mr Drew: Jan, you would agree with one of the points that was put in our discussion to the ISG that there were clear political parameters from the outset given to the ISG even though they carried out with rigour, as we know, a foresighted investigation around the hypotheses that they were out to discover?

Mr Rowe: Absolutely. I do not disagree with that at all, but it is completely different from what John Krebs proposed in his trial and what eventually was carried out. What we know now is that we have a very good interpretation of what causes perturbation and, therefore, any badger culling has got to take that into account, but it does not mean to say that it is necessarily going to happen in the same way in a different method of culling.

Q186 Mr Drew: Finally, what about this point that was again raised towards the end of the report that farmers should take more direct responsibility or ownership for the management of bovine TB? Is that something you can sell to your members?

Mr Raymond: Could I say on that (and I return to the report and relisten to the cost-benefit analysis of a possible badger cull in the way that had been outlined in the report yesterday), there was no account taken about cost-benefit analysis of the social implications to farmers, to the countryside, to the infrastructure of the countryside, particularly in the western part of the country where most of the cattle farming does take place, and I think before you can actually do a cost-benefit analysis you have got to look at all these issues from the social to the welfare of the farmer. We have heard about the welfare of the badger, we have heard about the welfare of cattle but we have not heard about the welfare of the people involved. As far as farmers taking ownership, I would suggest that farmers have been under restriction for many, many years. I believe that these farmers have taken ownership for many, many years (the pressures that are on them, the restrictions that are on them, the costs that are on these farmers), so to say that they need to take more ownership, I question, because if we put any more

pressure on these people I would suggest that we are going to make cattle farming in parts of the country totally unviable. People will disappear and the net effect to the management of the countryside comes into question. I do not know if you have seen our seven-point plan which we agreed with all other organisations within the farming community. If you have not, we are happy to forward the seven-point plan to yourselves, but it is an agreement within the industry last August where we are prepared to sit down, we are prepared to work in partnership with Government and we are prepared to actually move this debate from a debate of containment.¹ I would suggest that the containment that we have of this disease at the moment is not working, that we need to move into an eradication mode.

Mr Rowe: Could I add a little bit more, coming back to the science within the report which relates to that level of TB that appears to be driven by cattle to cattle transmission and not driven by badgers. I think we would take huge exception to the conclusion that was come to there. I sat for many years on the TB Forum. We had a lot of detailed information put to the TB Forum and I think the standard advice there was that in the three and four year clean area part of the country we totally accept probably 80% or more of the TB there was from cattle transmission. It was cattle moved out of the West Country to the clean areas, and that caused 80% of the TB there. 20% was unexplained, and nobody really knows quite what that was, but that only represents about 5% of the animals that are actually removed against TB. If you come back into the one and two-year test areas, which are the hot spots, then all the information that has been collected about farm breakdowns indicates that probably less than 20% in those areas is caused by cattle movements from one herd to another, but the rest of it is unexplained; in other words, herds that have not brought in animals but have had a breakdown. In those areas very often there has been trapping in the previous period before the trials and badgers have been found to have TB. I think the majority of those breakdowns have been put down to badgers, and I think, quite correctly so. It is very difficult to see where they come to the conclusion that only 40% of TB is actually driven by badgers and the rest is driven by cattle. The other point to make is that the skin-test in the clean areas works perfectly satisfactorily. It will clear up the odd incidence of TB that are moved into there, and do not forget cattle from the West Country. Yet, when you come back to the West Country hotspots, the skin-test does not work, it seems to fail, and this is what John Bourne eventually came down to saying, "We need a tighter rein on the skin-test", but the weakness of it is that it finds itself very hard to work when you have got this constant feedback reservoir which we have in the badgers. We have an extremely low level of infection in cattle, we are constantly removing them, and we are taking away small numbers of animals and we are talking away the

¹ <http://www.nfuonline.com/x22292.xml>

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ones we find. Even if we are leaving a few, it is a tiny fraction of the herd that is left with a very early level of infection and highly unlikely to be infectious, whereas those cattle are living alongside a badger community which we now know, and I think this report amply shows, has probably got far more TB in it than we think. I say that because of the speed with which TB appears to develop in badgers the moment you disturb them. In other words, there is probably a high degree of latency of TB in the badger population, which is very easily stirred up; in other words, probably more than the estimated population of badgers may actually be carrying it.

Q187 Chairman: You are deeply knowledgeable on this, Mr Rowe, and one recognises that, but it is difficult for us sitting here to fully absorb process and come to anything like a rigorous conclusion from the analysis that you are putting forward; so I have been trying to distil out of it some of the general messages. Let me just see if I have got this right, and do tell me if I am wrong. You are looking at ISG's work and your first observation was that the trapping techniques after the second year seem to have some question marks about them. In other words, the way you actually capture wild badgers. Were you suggesting that the statistical results in the areas where badgers were trapped and subsequently dispatched would have been statistically different from the numbers which have come up in their final report had alternative methods of trapping been employed?

Mr Rowe: I think there is a very strong possibility that if you had used a much more efficient way of trapping, probably gassing them and removing whole social groups at a time, where you are able to move much more quickly, and having a consistency of trapping, because, do not forget, this was only done once a year for a very short period of time—

Q188 Chairman: But over a period of five years?

Mr Rowe: Yes, but it was done once a year for probably a week, or less sometimes, but no more than ten days trapping at any one time in any one area, so it was very short bursts of trapping carried out over five consecutive years, whereas if we were looking at a cull that is more likely to be effective, it probably wants to be almost a continuous cull, maybe given that you have to have a closed season, but it would be operated on a much more continuous basis in a much more efficient way and, therefore, you may not get anything like the level of perturbation that you get here. What we have learnt is that if you trap inefficiently in a random way, because they were not removing whole social groups, you get a high level of perturbation. We totally accept that there is that problem.

Q189 Chairman: Just help me as the layman in this. What you seem to be saying is that if you went at it very intensively by whatever mechanical means you care to choose to remove badgers in a particular area, if you did that with intensity, with a high degree of frequency, the badgers in their little social

environment would not get the message that there was anything going on because there would not be any badgers around to transmit the messages to other badgers that life was getting tough, because there would not be any badgers around. In other words, if you were going for 100% removal of badgers in particular areas, your argument is that there would not be any perturbation because there would not be any badgers left.

Mr Rowe: At the extreme end, 100% removal, yes, that would be. Obviously you would get the incursion capabilities, but we know about that now so, having cleared, say, a middle ground, you would concentrate on the edge. You could either have a hard boundary, as we were talking about, where there are not any badgers to come in—coastlines, motorways, rivers—but if you had, say, soft boundaries, like arable land, where you did not have at-risk cattle herds but you knew there may be diseased badgers coming back in from those, you could do a more intensive follow up to try and keep the middle area clear. All I am saying is that there are probably, from what we have learnt in this trial, much more efficient ways of doing it. It may be quite demanding on manpower, but if you can get the farming community to go along with that, I think we could actually do a much more efficient job.

Q190 Chairman: I suppose the problem in the real world is what is practical, what is replicable. The message I got from the ISG was that, unless you had a trapping and subsequent culling policy, a dispatch policy, that was carried out professionally and carefully, you would not really have very much of an effective policy to be going on. I suppose we also come from the point of view that we are in something of a bind here, because the only piece of controlled work that has been done is this one. There is not an alternative model in, in this case, English circumstances where we can go back and compare and contrast. The thought was going through my mind when Mr Gibson said on your behalf, "We do not accept the findings", upon what basis do you then produce an analysis, say, "I do not accept it", and what kind of a basis of analysis do you then subsequently follow to say what is the alternative that would have the same degree of scientific validity that the peer group review of the ISG work seems to suggest? You want to put a different point of view forward. Upon what basis are you going to advance the alternative strategy, apart from the observations you have put to us today?

Mr Rowe: In essence, what we have learnt about is that culling in an inefficient and cumbersome way, as cage trapping is (and I have seen plenty of cage trapping and it is a slow, tedious, difficult job, very manpower heavy, not particularly welfare friendly, I would have to say, but very inefficient), and I think it is perfectly possible to devise much more efficient ways of trapping, and we know now that is very necessary. We do have evidence that where trapping is done thoroughly—okay, it is not replicated science, but it is very strong empirical evidence from the Thornbury trials, Steeple Leaze, Hartland Point,

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previous trapping done in this country, the Ireland work as well—lowering badger density significantly has a very big effect.

Mr Raymond: Can I follow that through? I think we can have comparisons with the Four Area Trials in Ireland, where the methods used were different, but I think it is down to the methods of control and there is no doubt that, if gassing was allowed as a method of cull, then you would have far less perturbation, it would be far more cost-effective and far more acceptable to the farming community as well. So, there are many areas around the perturbation argument on method, logistics and how you actually deliver a possible cull.

Q191 Chairman: In the light of these diametrically opposed views, yours and our previous witnesses, what should the Government do now?

Mr Haworth: Listen to us!

Mr Rowe: The big problem (and it depends on how you assess the level of TB that has been driven by cattle or that has come from badgers, and we suspect a vast amount more than John Bourne is indicating comes back from badgers in the hotspot areas) is that somehow we have got to find a way of breaking that interface, and while husbandry methods may have a place, and certainly do have a place where we know about them, that they are actually particularly capable of breaking in to a point where we can see a big diminution in the disease, I think some method of reducing the disease in the badger population at the moment, and that is only culling, has to be part of a long-term policy, otherwise I just do not think we are going to get anywhere.

Mr Raymond: I honestly believe that it is going to need a passage of measures if we are going to control this disease, and I would hope that Defra, looking to the longer term, would change its strategy from a strategy of containment to one of eradication: because this disease is out of control, this disease is spreading outwards, and that is disease into cattle, disease into the wildlife, and unless we act soon I can see a huge area of the country where cattle and badgers are diseased, and that is going to compound the problem, and so I think we need action and we need action soon. A lot of the people that we represent are going to be totally frustrated by this report, because they thought this was going to be an opportunity for Government (Defra) to change their policy and actually be seen to be serious in driving towards an eradication programme.

Q192 Mr Gray: Have you had any indication at all. Have you spoken to Defra since the publication of the ISG's report, are you planning to speak to them in the near future, or have you had any indication from them that they are ready to discuss the matter?

Mr Raymond: We are hoping to get a meeting within Defra as soon as possible. Obviously, I guess there might be a change in ministers, and so forth, as of next week, but we did have some discussions with the officials on the edge of the meeting yesterday and, yes, we do need to sit down and talk. We as an

industry are prepared to play our part. I can re-emphasise the fact that we have a responsible partnership here trying to actually move this argument forward.

Q193 Mr Gray: Of course. The reason I am asking you is that there was a hint earlier on in the year that Defra considered the next step would be further consultation, but if you were Defra ministers now and you had this report, would you make an announcement now, in which case what do you think that announcement would be, or would you seek further consultation with the industry? What would you actually do if you were a Defra minister?

Mr Haworth: I think the statement by the Secretary of State the day that the report was issued indicated that he wanted a short period of time to reflect. I think that is entirely reasonable. We are very anxious to talk with the Secretary of State and with officials to try to help construct a strategy, a comprehensive package of measures, as Meurig said, which would start to reverse the spread of the disease and start to eliminate it. I think that this needs to be done in a relatively short period of time. I think we should be talking a month at most.

Q194 Mr Gray: Presumably one of the areas you might like to discuss with ministers, if indeed the NFU could do that, would be this question of the parameters; the discussion we had a moment ago on the whole question of the method of catching them but also presumably the question of the size of the area which the culls tested. You could argue that the whole report is flawed because of the parameters that were set down for it. Do you think that is likely to be a useful area of discussion to take forward, namely to say, "We do not particularly like the outcome of this report, but, had you asked different questions, you might have got different answers"?

Mr Raymond: Yes, I think that is a very important issue that we would want to speak to Government, to Defra, on. We have spoken to landowners, we have spoken to farmers in certain parts of the country. You can look at parts of the South West, you can look at parts of Sussex, where there are boundaries, and, as Jan said earlier, they do not have to be hard, physical boundaries, we can have boundaries between different types of farming, forestry and so forth, and I believe that we have templates, we have an understanding from the farming community, even the landlords, that unless we do progress this argument and come up with a different strategy, then I fear that cattle farming in certain parts of this country is going to become totally unviable and the whole industry is going to crumble. Unless we get some firm decisions and movement on policy, I fear for the future of the cattle industry.

Q195 Mr Gray: One last question before we move on. When we took evidence from the ISG on Monday of this week one of the things they said was that they found it difficult to carry out the tests

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because they got such a bad level of support and co-operation from the farming community. I think they said 30% or 40% of farmers allowed them on to the land. Supposing this was to change, surely we need a better level of co-operation from the farming community if we are going to carry these kinds of tests and discussions forward?

Mr Raymond: We have conducted at least three surveys in the last couple of months, one with a group of farmers in Sussex who are hemmed in with some fairly vigorous boundaries, and between 75 and 80% of the people we contacted within that area, landowners and farmers, are fully supportive of a cull in that area because they believe it is the only way they are going to eradicate the disease in that part of the world. There is a template in Devon, in the Holsworthy area, where we have contacted 230 farmers, and they are determined to move forward in a cull policy. I think it was some 12 months ago when we used the expertise of Exeter University. They did a poll in the South West of, I believe, over 1,600 farmers and landowners, and we came up with a figure of 70 odd per cent who were supportive of action within their given areas. So, we have talked to farmers, we have spoken to landowners and I believe we have the evidence now in place that the co-operation is there because people are determined that this has gone on for long enough, the disease has got out of control. We do need to change the strategy, as I said.

Q196 Sir Peter Soulsby: I was going to ask why you think the Irish seem to get a higher level of involvement from landowners than apparently has been the situation in Britain?

Mr Raymond: If you look back over the last number of years at the RBCT Trials and so forth, there has been concern of intimidation, victimisation, and so on and so forth, within the farming community, I have to say, and, again, speaking to farmers who are affected, you look at the Irish trials, you look at what is happening in Ireland, the industry is convinced they are seeing a real reduction in the disease levels in Ireland through the strategy which the Irish Government have implemented, and I think this is convincing the industry that this is the only way forward.

Mr Rowe: Believe you me, as a farmer myself, if I believed in our situation that we could just cull-test our way out of this problem (and I make the proviso that we would probably have to have the right levels of compensation in order to be able to survive the effects that might have), I would willingly do it. I just do not, from the experience that we have got in the hotspots, believe that it is remotely possible. We are testing cattle at the moment up to our eyeballs. I have just come out of virtually a six-year period of testing every 60 days, and it is just an absolute nightmare. If anybody says more testing in my herd is going to make a big difference— It may be that the gamma interferon might have speeded up things, but if the problem is due to spill-back infection from

wildlife, it will not actually cure it. It may just remove a few more animals at any one time, but the same problem will occur the next month afterwards.

Mr Raymond: We do not merely look at the experiences of the Republic of Ireland over the last few years; you can look at the way Australia tackled the problem, and they are more or less totally eradicated, but they took the decision that they had to eradicate the disease in all sectors, in cattle and wildlife, and by adopting that strategy over a period of about ten years they have moved from a highly infectious cattle herd to just about total eradication. So, it can be achieved; it just needs willpower.

Q197 Chairman: We are told that Defra wants to make whatever decision it will ultimately make based on sound science. We questioned earlier what the definition of “sound science” was, and it is probably something we could carry on talking about all afternoon and not come to an absolute conclusion. However, you have given us some technical reservations about the way in which the trials were conducted and you have prayed in aid work in Australia and Ireland and other jurisdictions to come to an alternative conclusion than that done by the ISG. Are you aware of any English scientific work, focusing on the English situation, which would provide any kind of rigorous alternative analysis to the ISG’s work? I do appreciate that there has not been a parallel exercise, but there may be somebody who has done a rigorous analysis over the years of the way the ISG have operated and perhaps come to different conclusions. Are you aware of that work?

Mr Rowe: I do not believe there is any that I am aware of. We are not criticising the way the ISG have done their analysis and the work they did, what we are saying was fundamentally the method of culling that was actually used was one that was almost designed to create perturbation and, therefore, is terribly difficult to draw conclusions from. No, there is not any other work that I am aware of.

Q198 Chairman: Again, I am trying very hard to not, if you like, form Jack’s conclusions on this but to learn from the differing points of view that are put forward. The perturbation effect is an argument which, from what we have heard, is very relevant to a smaller scale of operation. What the ISG seem to say is that, if you have really big areas, then culling is an option. In fact, my eye was caught by the statement that was put out by Professor Dennis Mollinson, statistical auditor of these trials, and he drew the attention of the reader to this sentence, and I hope I do not quote it out of context, “For that the ISG’s calculations suggest that areas of at least 455 square kilometres would be necessary if you were going to have really big trial areas.” I hope I have not got that wrong. I suppose what I am grasping towards is that, if you do it really big enough, perhaps you draw some comfort from the fact that large scale culling, according to this, might be

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effective, but that is juxtaposed by the ISG's conclusion that culling is ineffective. How have you reacted to those juxtaposition conclusions?

Mr Raymond: Again, without actually studying the report in detail, I guess they have arrived at that conclusion from a cost-benefit analysis, I would suggest. I think it is down to the perturbation effect, as we have said earlier, and the edge effect, back down to the area of boundaries, whether it is hard or whether it is soft, and I honestly believe that we can overcome this issue of boundaries if you look at the typography, particularly in the South West, and you are back to the method of culling.

Q199 Chairman: Let me come to a very simple question. How long is it going to take you to thoroughly analyse this report from the Union's point of view?

Mr Raymond: We are scrutinising and studying the report at the moment.

Q200 Chairman: I appreciate that?

Mr Raymond: It is going to take some time.

Q201 Chairman: The reason I asked that question is that our earlier witnesses felt there was merit for a period of time and reflection on the data. We are aware of political events which are going to be occurring next week and, in terms of the time for public and Parliamentary scrutiny, we have got about a month left; so I suppose what I am looking for is some steer from the Union as to whether you would be happy if hard and fast decisions were taken within a month or whether, in fact, it would be better, given the length of time this problem has been around, to perhaps reflect for a few months before hard and fast views were arrived at?

Mr Raymond: Before I ask Martin, I would suggest from a farming point of view that the farming community would want decisions sooner rather than later. They really had been led to believe that this was going to be a report that was going to deliver a change in strategy that was going to help to eliminate the disease. From an organisational point of view (and our professional people have to study this report from a timetable), Martin, perhaps you could comment.

Mr Haworth: I think the important thing would be to take a decision in principle to have a comprehensive strategy to eliminate the disease. Clearly the methodology and techniques would require a lot of discussion between the industry, and that certainly could not be done in a month, that would require perhaps quite a long period of elaboration of a detailed strategy, but I think the important thing from the farming community's point of view is that a clear signal is given that we are going to move forward to a strategy.

Q202 Chairman: I appreciate that, and I think we have gained some understanding of the very real human dimension of this, never mind the economic one, which again you have underscored, for the farming community, but what I am trying to get

clear in my mind is this. The Minister, whoever that person is, has got a piece of solidly based scientific analysis, peer group reviewed, which says that culling is not a realistic alternative. That is the information that the ISG have come up with. You guys are saying, "Well, we have got to spend time looking at it." If you are going to be able to produce an alternative body of evidence argument, there has got to be a bit more rigour about it than an opinion, because Meurig gave us the view, quite rightly, from the front-line of what deeply frustrated farmers feel, and I can understand that. As I said on the radio today, they must have had steam coming out of their ears when they read this, because they have to live with it every day of the week, but a minister has got to have a solid basis to come to a conclusion once and for all. So, I come back. How are you going to develop the methodology to give you a firm footing to argue against this piece of science, this report?

Mr Haworth: First of all, I would like to come back to the comment I was about to make before, which was the ISG report has been circulating in Defra in draft for some time. We have never seen it but the persistent echo that we got back from those who had was that this report was going to show that 100 square kilometre culls were not big enough and that the conclusion is that, if you are going to have a culling strategy, it needs to be done over a larger area and be done persistently and over a long period of years. That is what we understood to be in the report. It seems to us (and this returns directly to Meurig's first comment) that this report has been slanted at the last moment to read to give a definite steer against culling.

Q203 Mr Drew: That is not true. Come on. Let us get real. If you talk to anyone from the ISG, and we have talked to them on numerous occasions, it was absolutely clear, besides the fact that they were even more adamant at the end—we knew where they were going to—they were going to come up with that rationale. It is not true to say they suddenly changed their minds.

Mr Haworth: If that were true, everybody, including me, never having seen a draft of the report, why was it the case that everybody that we talked to said that this is likely to be the conclusion?

Q204 Mr Drew: They are all spinning, that is why, and that has not helped things, has it? Everybody has been spinning on this report.

Mr Haworth: How is that going to help? To whose benefit would that have been?

Q205 Mr Drew: It has not helped at all. In other words, if people had actually waited until the ISG report had come out, they could have seen this trend. It is absolutely clear from the reports that we have done, we have our criticism of the ISG, we have our criticism of some of the ways in which they have applied the test, but no-one could criticise the direction in which they were travelling.

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Mr Raymond: Can I support Martin on that, because there was that one weekend where there was the article in *The Sunday Times*, there was an article, I believe, in *The Daily Telegraph*, there was an article in *The Farming Press*.

Q206 Mr Drew: They were wrong, were they not?

Mr Raymond: They were categorical that there was going to be movement, there were going to be decisions on the back of this report. If you are in the farming community and you had been led to believe that there was going to be a change of policy, it did give the industry and the people some hope. Something happened between those articles and the report. Whether it was spinning or whether we were sent up a merry avenue, I honestly do not know.

Q207 Mr Drew: Not if you talk to the ISG?

Mr Raymond: The impression for the farming community leading up to the launch of this report was totally different.

Mr Haworth: If the report had been presented in that way, which I think would still have been consistent with the results and the facts, that it would be possible to consider constructing a cull on a different basis but it would have to be over a bigger area, et cetera, then you would not have been asking the question how could a minister now make a decision on it?

Q208 Mr Williams: I think we are all wrestling with the report, and the Chairman has already quoted one sentence out of it. I think, if I had a criticism of the report, it would be that while the science on the tests that were done was good, in terms of looking at other culling operations there was a suggestion, because the edge effect gets less as you get bigger, that it was worth looking at then; but then they extrapolated it to say that that was impossible practically because of all the costs of doing the experimental work that was done. I think the NFU missed a real trick. The NFU should have stepped up to the plate and said, "In practical terms this can be achieved because we can persuade our members to undergo the training, welfare, ecology and whatever to get that work done, because if it is only a practical problem, then that can be achieved, if it is a scientific problem, then that cannot be overcome." Surely the NFU really missed a trick?

Mr Raymond: Can I pick that up, because we are moving from the science to the practicalities of a cull, and I will to return our seven-point plan. Right across the industry only last August (and I would suggest that we forward a copy of the seven-point plan to yourselves—I am not going to read it all out now) we were talking here about sitting down with Government, forming partnerships in given areas with vets, with the SVS. Here is a professional group of people, it was talked upon earlier, the SVS, the vets on the ground, here we have organisations, highly professional people who are of the same view as us. If we are going to move this argument forward, they want to be part of this partnership. So, I would suggest to you, Roger, that we have put our

plan to ministers, we have put our plan to officials in Government, this has been publicised and we have argued this all the way through, and that plan is still on the table. We are prepared to pick this plan up and work with Government and officials at any time, and the same is said for the veterinary profession and all other organisations around the farming industry.

Mr Rowe: If I could add to that. I think part of what we have got to look at thoroughly is the cost-benefit analysis, which actually probably drew a lot of the decision-making that John Bourne finally came to, and I think we would actually dispute that, but the difficulty is having hard evidence to come up with different figures. If one looks at the figures that have been put in for the cost of culling, they seem extremely high. If you had significantly lower culling costs, which I think, obviously, would be the case if the farming community got involved in it, and you had much greater benefits in terms of a more efficient culling, reducing TB levels in cattle, you could very quickly change that cost-benefit analysis to be very much more favourable than it appears to be based on the type of culling they did and the cost of doing it.

Q209 Chairman: I am going to do something a little bit unusual now. You have made a number of comments about the ISG. It so happens that Professor Woodroffe of the ISG is with us, and for the basis of dealing with the factual observations that you put forward, I am going to ask Professor Woodroffe if she would not mind coming forward and commenting particularly on the methodological conclusions. I do not want us to get into a sort of debate, but there are some questions about the facts, particularly with reference to the way conclusions were drawn, which I think might be helpful. I hope the NFU do not mind, but the ISG have been mentioned. If, Professor Woodroffe, you could concentrate, and thank you for agreeing to do this, on some of the facts about methodology and the way that you came to your conclusions just to put on the record the ISG's response to the important point which the National Farmers' Union have made. I am sorry to bounce this on you out of the blue, but, as you are here, it would be quite useful. The NFU can tell me if I am wrong, but there was a sort of implication that somehow you had started out going one way but, towards the end of the game, you had been leaned on and come to conclusions which were somewhat different from the impressions as to what your conclusions were that had been gained by virtue of various public insights. Mr Haworth is nodding, and it is reassuring that I am not misinterpreting you. Perhaps you would like to start there. Were you nobbled?

Professor Woodroffe: Allow me to preface my remarks by saying that I came here purely as a tourist.

Q210 Chairman: Well, this is the ultimate tourist experience.

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Professor Woodroffe: I feel like the person who has been pulled out of the audience to play Carmen! In response to your question, “Were we nobbled?”, I would say, no, we certainly were not. Any of you who have met Professor Bourne and other members of the ISG would understand what a challenge that would be. I should also add, in my role here as a tourist, that, of course, the other ISG members are aware that I am here but I certainly am not here as a representative on their authority.

Q211 Chairman: Let me make it very clear that we accept entirely that you may wish to respond in a personal capacity, that obviously the ISG as a collective may not have a line, but you do have the benefit of being part of our panel of four witnesses on Monday, you were part of the whole exercise and you are better acquainted with how the ISG operated and came to its conclusions than anybody else. The points that have been raised are of a technical nature. There is, if you like, a separate agenda of the politics and the way we go forward, and I am not asking to you comment in any way, shape or form on that, but I am anxious that we clear up, from the methodological point of view, the ISG’s response to some very important points that have been raised by the NFU.

Professor Woodroffe: I certainly can say that we were not nobbled. I think that perhaps one of the issues that may have caused, confusion is too strong a word, but there is a difference between the way that one writes a scientific paper (and this is something we discussed in our evidence session on Monday) and the way that one writes a report which is aimed at a more general readership. So the phrasing that one uses in writing a scientific paper is very, very cautious. If one says in a scientific paper, “This raises serious concerns about the potential role that badger culling can play in future control of cattle TB in Britain”, which is the sort of thing that we say in the final paragraph of every scientific paper we have written over the last two years, that in science speak means, “We do not think this looks promising. We think it is very unlikely this is going to help”, and as our conclusions firmed up and our data became greater, more numerous, our confidence intervals reduced, our certainty became greater, so over the course of those years you will have seen a strengthening of the language, culminating in what you see here today, but this is certainly not something we were pressurised to change by any party whatsoever. This is the unanimous view, and I can say that this is something that the ISG speak on with one voice.

Q212 Chairman: Can I ask one practical thing. Refresh my memory, because some comments are being made about the cost-benefit analysis. What you seem to say is that, even on a large scale basis, culling is not worth it, but that couples two different things: (1) the ability to control a disease by a process of removal of infected animals and (2) an economic appraisal of the results. I had thought that one of your conclusions was that, if you made the area big

enough, culling would have a contributory element to controlling the spread of bovine TB. So, putting aside the cost-benefit analysis, am I right in saying that, if you make the area big enough, you could see, I think it was a 23% drop, was it not?

Professor Woodroffe: What I would say to that is you are absolutely right. In disease control terms, if you make the area very large, the benefit that you see in the area that you actually cull begins to dominate the system to the extent that they offset the detrimental effects outside, and that includes caveats about having to repeat it over several years. There is an issue about time as well as space. If I can finish answering that, I think, yes, we absolutely agree and recognise that in disease control terms, if done in the way that it was performed in the trial, if you just expanded that space, that is what we expect. The important point to bear in mind, though, is when you do that expansion it depends absolutely on that caveat about “if it was as it was done in the course of the trial”. The cost that I think really needs to be taken into account, or that the ISG thinks needs to be taken into account, is the cost of “if you do not do it as it was done in the trial”, therefore if you do not do it with the level of resource and the level of focus and attention of a dedicated team.

Q213 Chairman: So, if there is an area for debate and discussion, it is a methodological one as well as an economic one.

Professor Woodroffe: Yes.

Q214 Chairman: But in terms of the focus, in other words if you do what you did in the trial—

Professor Woodroffe: Yes.

Q215 Chairman: —then there is a potential for reducing the incidence of bovine TB. I am going to ask another question that follows from that. If you were to couple that with the kind of rigorous testing and movement controls to which you also refer, you made an important point (which I recall) on Monday, which was, in the context of movement controls, you thought that under certain circumstances you could get on top of the spread of the disease; in other words you would start seeing the incidence coming down. I think my question as the layman is that, if you coupled very rigorous movement controls and testing with the kind of culling arrangement that we have just discussed over a big enough area, do you see the graph of incidence really starting to come down? Can you put the two together and come to a conclusion?

Professor Woodroffe: I have to say here I am speaking in my private capacity and with the acknowledgement that I am a badger ecologist and a wildlife disease expert.

Q216 Chairman: Before you answer, if you feel uncomfortable about answering, I would say stop, but if you want to go on we would love to hear you.

Professor Woodroffe: No, no. I think I can comment. All that I will say is that we have not—. One issue that has been raised is that, as you will notice, the

level of experimental work done on the badger side at the instigation of the study was much more extensive than the work done on cattle. So, it is very clear that the cattle recommendations are deliberately less specific because the volume of data that we have on the cattle side is not as great, and Professor Bourne has given on the record the historical reasons for that. So, we have not explored in any quantitative way, we have not tried to extrapolate combining cattle and badger culling approaches.

Chairman: Mr Gray wanted to ask a specific question.

Mr Gray: I am absolutely delighted to hear your protestations that you were not nobbled. It would be quite wrong if you were, because it would be astonishing if you came along and answered the Chairman's rather rude question, if I may say so, Chairman, but there is definitely a difference in tone between what Professor Bourne said in his letter dated January 2006, where he made it perfectly plain that, under certain circumstances, a mass cull would be beneficial and, indeed, the conversation we have been having even this afternoon and Monday where you equally indicated that there are circumstances—a wider area—where an intensive cull would be beneficial, leaving aside costs and all that. There is a very great difference between those kinds of flavours and the actual report itself, where the report makes no comment at all about there being any benefit in culling. He was slightly (and was very, very clear) anti-cull. Just before we move on to the question, even as recently as 3 June when the letter from the Secretary of State went round saying that co-ordinated efficient culling over large areas might work, there were indications that it might, so let ask me this question. I know there have been quite a large number of drafts of the report over a number of months. How significantly different is the final printed version of the report to the first draft that you saw?

Mr Drew: Did Alastair Campbell have anything to do with that?

Q217 Mr Gray: Alastair Campbell has left now.

Professor Woodroffe: Nobody even resembling Alastair Campbell has been anywhere near it.

Q218 Mr Gray: How different is the final one to the first one? Were there significant changes over the course of discussions on the report?

Professor Woodroffe: No, there were not. The way the report was written was that the chapters were written as freestanding chapters with one ISG member taking the lead on each one. Obviously, we started with the data ones and then the interpretation of those were built up once we had really produced a coherent review of the data that were in place, having got the final numbers on the impacts of badger culling on TB incidence in cattle. We finalised those numbers having historically—. I think this is one thing that is important to note. To date all we have been talking about was percentages, 23% here and 29% there, and we were being told

actually by Professor McInerney, who is the economist on the ISG, that 23% is not very useful to deciding economics and policy.

Q219 Mr Gray: My question is not so much about the science and the detail, my question is about the conclusion and the structure of the report. My understanding was that the first draft was pretty much the same as the printed one, is that right, in terms of general thrust?

Professor Woodroffe: Certainly. If you are talking, for example, about chapter ten, the policy options, which is probably the thing that you are most interested in, the first draft looks pretty much identical to the final draft.

Q220 Mr Gray: Final question. As far as you are aware, and you might not know the answer to this question, at what stage did ministers first see a draft?

Professor Woodroffe: Ministers were sent drafts in sections. They were not sent a spiral bound thing that looked like this.

Q221 Mr Gray: No, but that chapter you referred to?

Professor Woodroffe: That chapter, I cannot recall. I would have to ask Professor Bourne that question.

Q222 Chairman: The overview that Professor Bourne wrote, which pulled it all together, when was that put in?

Professor Woodroffe: Once again, I would not want to go on. I actually cannot remember without them here.

Chairman: Thank you very much indeed. It has been a marvellous bit of tourism on your part and I hope you did not mind this unexpected visit to the front row, but we are very grateful to you for coming on board at extraordinarily short notice and answering. Thank you very much indeed. It is very kind of you. Roger did you have any more questions that you wanted to raise?

Mr Williams: Not on that particular issue that we were talking about.

Chairman: Then we move on to Peter on Ireland.

Q223 Sir Peter Soulsby: As I remarked at the time, and the witnesses from the NFU have heard what was being said by the Badger Trust, in particular, about the Irish experience, it is very clear that you have come to very different conclusions about its significance. Why do you come to such different conclusions?

Mr Raymond: Could I open it up and then hand over to Martin, because Martin and I, and one or two others on our professional team, went across to Ireland this time last year, so we saw at first-hand. Over a period of three or four days we met the farmers' organisations, we met the State Veterinary Practice Government officials and we were shown figures on what has been happening since they introduced a dedicated cull, which was some three years ago. The figures that we were shown were showing a reduction of 42% in cattle slaughtered. The enthusiasm and the determination of pursuing

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the policy they have put in place, I thought, demonstrated to me that this was a way forward. They had full co-operation from the farming community, from the landowner community and they were fairly optimistic that over a period of time they were going to reduce the incidence and possibly get to some form of eradication. So, having looked first-hand on the ground, speaking to farmers, speaking to the State Veterinary Practice over there, I have to say, since coming back and having a long conversation with the Minister of Agriculture and her officials at the Oxford Farming Conference last year, again, she was reinforcing the line that the options and the strategy which they were implementing was having a huge beneficial effect. She found it strange that we had not followed a similar sort of policy.

Q224 Sir Peter Soulsby: The Badger Trust, in some considerable detail, explained to us the other factors that had changed over that period of time. Why do you think that they were wrong in attributing the changes to those other factors and why you are right in attributing them to culling badgers?

Mr Raymond: We have been involved in pre-movement testing of farms in one and two-year testing areas since last June. The Irish State Veterinary Practice had abandoned pre-movement testing at the time that they moved over to a culling policy of wildlife, because they felt that pre-movement testing was not working. They moved to an annual test rather than a pre-movement test. They were linking that to a cull programme and they had seen a remarkable reduction in the incidence and the number of cattle affected.

Mr Haworth: I think the Badger Trust were trying to say that the reduction is largely due to cattle measures which were brought in. As far as we can see, there is not a huge difference in the cattle measures which are in place in Ireland or in this country. They talked about the use of gamma interferon, which has now been used in this country, they talked about restrictions on herds, to break down herds. I do not believe that they are in any way different in Ireland and in England. The difference is that they stopped pre-movement testing in 1996 and never reintroduced it, whereas we have introduced it. If anything, I would have thought that the cattle measures in place in this country are probably more restrictive than they are in Ireland. I think that we would think that the reduction is largely down to a cull. It is interesting that the cull is actually effectively a reactive cull, which is the one that the ISG discounts out of hand, almost without consideration, whereas in Ireland it seems to be working. The reason that it works there, I think, is that they have a very quick reaction time, they have a much better system of cattle tracing than we do, they immediately look at any breakdown and see if it can be associated with a cattle movement and, if it in any way seems to be, then they do not take any measures against badgers. If it is not immediately explicable by a cattle movement, they do what is effectively a reactive cull. Their culling technique is more efficient

than ours because they use snares rather than traps. There is no closed season in their culling, whereas in the ISG trials there were. They are rigorous, they do it often and they persist for a long time. I think all of those things lead us to believe that in the Irish circumstance that has caused the reduction. Interestingly, there is hardly any, I do not want to say no, evidence in Ireland that neighbouring farmers are concerned about the perturbation effect. It does not seem to be an effect that causes, as you would expect if it was there, neighbouring farms to be very concerned about the policy. It does not seem to happen. I think, again, the ISG tried to draw a distinction as to why the Irish experience should not be used as a comparator in this country, and the reason they come down to is that the density of badgers is much less in Ireland than it is in England, which, I think, would point to a hypothesis which they ought to have followed up. Is there a link between the density of badgers and the incidence of TB in badgers and cattle. That would have been an interesting hypothesis to have followed up, but they did not seem to do that. I do not know why. Perhaps our previous witness, as a badger ecologist, could have commented on that as well.

Mr Rowe: Could I make a couple of points. That last point is interesting because what we know about the ISG trial is that there was a plateauing out effect in their ability to lower the population levels beyond a certain point. It seemed they were catching the same amount each year after a while, and the interesting thing is that the population that the ISG ended up with is about the same level as the Irish started with. So, if we could drive that level down further than the ISG got to, we might make significant inroads into the disease transmission back to cattle much as the Irish have demonstrated. The other point that was made by the Badger Trust was about different interpretations or varied levels of TB in badgers that seem to come up in the Irish reports, and that is because they looked at badgers in two different ways. Whenever they were looking at groups of culled badgers, they would do crude pathology on them, which is where the 15 to 20% infection came, but what they found was that when they did detailed culture on those badgers it went from somewhere between 40 and 50% of badgers that they were culling were infected (carrying TB), which comes back, I think, to the point I made right at the beginning, that it appears that our infected badger populations are much the same, that they seem to be able to develop TB very quickly once they are disturbed, and they are probably latently carrying much higher levels of TB than some of the RTA data seems to indicate.

Mr Raymond: Can I follow through two avenues. Again, I return to Professor Simon More's paper at the Annual TB Conference. He reinforced the line that the policy in Ireland is working, as the policy of the outline in Australia had worked, so that, I think, was an extremely good paper, and I am just picking up percentages where we saw figures (again reinforced by Professor Simon More) that the reduction is around 42% in Ireland. Professor

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Woodroffe stated 23%. As long as the edge factor and the perturbation was organised, as long as the method of cull was systematic, I just sit here and I think to myself that representing the farming community, people who are at the coal face, the people who are suffering, if you were to average 42% to 23% and have a 30 odd per cent reduction in TB in the cattle herd, that would be a huge step forward. We have got to look at all this data and hopefully come to the right conclusion.

Q225 Chairman: One technical point. Would you be confident that other measures could deal with the 70% that was left?

Mr Rowe: You are only looking at cattle testing, basically, as proposed by John Bourne and the ISG.

Q226 Chairman: If you have got a 30 odd per cent reduction in the rate of incidence or an absolute drop, I am not quite certain which it is, but a drop, then, if you are going get on top of it, what you may see from the drop, following your thesis, is that, if you like, the numbers of cattle affected by it, by definition, becomes lower, but your strategy wants to lead to elimination of the disease, because that is where we are all trying to go.

Mr Raymond: Yes.

Q227 Chairman: So the question is, within the sum total of knowledge of testing, retesting, cattle movement, before and after a movement, for example, would that package, if it was properly applied, be sufficiently robust to eliminate the rest of the disease incidence over time question? I do not know the answer to that.

Mr Rowe: I think the risk—. We do not know what the effect of ramping up even further the cattle testing side of it is going to be. The big worry is that it may destroy the industry before it destroys the disease. That is the huge worry that farmers have at the moment because, even under current policy, we have a business threatening policy there.

Q228 Chairman: The “do nothing” option is a gradual painful decline.

Mr Rowe: The point I made about ramping up the cattle testing was that, firstly, we do not know what effect it is going to have. I suspect in the short-term it may take out quite a lot more animals, particularly if you applied gamma interferon at a wide level, but at a great expense both to farmers losing animals and the effect that has on the business and the tax payer paying for the test, if the tax payer is going to do that, because it is an expensive test. That may, in fact, ultimately reduce the number of animals after probably a peak, and then it will drop away, but if we do not break this interface of reinfection from the wildlife reservoir back to cattle, it may not make much difference to the herd level breakdown, which is probably happening because of one animal in 500 in the herd that has come across and infected the badger in its pasture, but we just do not know. It is

hypothesis that has been presented to us, it is hypothesis whether it will work or not and what the economic effects of it are.

Mr Raymond: Can I follow that through. There are lots of cattle measures in place where the herd does break down. There is a herd restriction, there is pre-movement testing out of cattle herds in one and two-year periods, there is the total herd test, gamma interferon is now being rolled out; so there are lots of cattle measures already in place, and, unless we roll out gamma interferon across the whole country, I do not think we would have a problem with that, but there is a huge issue around the cost. I thought it was fairly strange that the ISG had done a cost-benefit analysis on the cull of wildlife when we did not see any figurers on cost-benefit analysis of further cattle measures and who is going to pay. Because one thing I can assure you, the farming and industry people, who are suffering in these hotspot areas, are in no position to pick up these extra costs and, on top of that, we also hear of total herd dispersals in herds that have been persistent with TB for years. We are talking about destroying lots and lots of cattle, and I have to say at this point, when you start looking at the valuation system and the compensation system that is in place at the moment in England, a lot of these people are just going to disappear out of cattle farming. Again, I return back to the cost-benefit analysis that has been done on a possible cull. You have got to look at the whole social, economic basis, the infrastructure and the countryside management and the whole food supply chain, because I think this is a much big picture than just pounds, shillings and pence and a possible badger cull. I think the same definitions should appear in any cost-benefit analysis on these cattle measures.

Q229 Sir Peter Soulsby: I wonder if you would forgive me if I return for a moment to the NFU’s attitude to the ISG report. I entirely understand the disappointment at its conclusions, and also I understand the very deep concern that there is amongst their members of trying to find a way forward about this issue; but they have been very critical, not just of the report but of the authors of the report. On three occasions, on my count, they have described the report as slanted, they have described it as flawed, they have described the authors as having approached a part of the drafting of this report in a way that, to use their phrase, “suits their purpose”, which certainly implies that they have been less than rigorous in their approach, and I think at one point described them as having slanted it at the last moment. Those are very serious criticisms, not just of the report, but of the integrity of its authors. These are respected scientists. They are impartial and rigorous in their approach insofar as we know. I wonder really whether you might want to reflect on what you have said about the report and its authors and whether you really feel that there is sufficient evidence to make those very serious allegations about their integrity stand up?

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Mr Raymond: I do not believe that we have questioned the integrity of the authors at all.

Q230 Sir Peter Soulsby: With respect, if you accuse a respected scientist of having produced a slanted report, that is a fairly serious attack on their integrity.

Mr Raymond: When you think back to the remit that was given to the ISG ten years ago, which is probably not where we would have started from, it was the information that we were being fed, I have to say, leading up to the presentation—

Q231 Sir Peter Soulsby: That is very different from accusing them of having produced a slanted report. It is a serious accusation.

Mr Rowe: Could I add, I personally have not done that at all, and I am not quite sure whether the NFU have.

Q232 Sir Peter Soulsby: I have been counting. On four occasions (and you can look at the record afterwards) you and your colleagues have used the word “slanted” in your description of the report.

Mr Rowe: Is this in press releases?

Q233 Sir Peter Soulsby: No, in evidence to us today, and I invite you to look back at the transcript when it is produced. You have on four occasions used the word “slanted” in your description of the report.

Mr Haworth: I think what we said was not that the report was flawed but that the trials themselves on which the report was based was flawed, and that in presenting their conclusions we were inevitably led to the conclusion that somehow the presentation of the evidence, the presentation of the conclusions, had been, let us say, strengthened rather than using the word “slanted”, possibly at the last moment. That may be explicable by what Professor Woodroffe said.

Q234 Chairman: Hang on just a minute. This almost gets the impression that you were given indications by others, possibly from within Defra, that the conclusions which the ISG were coming to were of a different analysis to the one that emerged. Hence the basis of your observations that what you thought was coming turned out to be different from what arrived. The reason I invited Professor Woodroffe to come on to very kindly give us the benefit of her observations was to address precisely that particular point, and the impression gained from her helpful observations was that the ISG had remained true to their last. In other words they reported what they found, and they did it in a way that was not interfered with by other parties. That was clearly the view that I formed from listening to what she had to say. I do not want to make life unnecessarily uncomfortable for you, but who in Defra has been giving you this sort of insight: because I did not hear from Professor Woodroffe that they had been giving in little dollops to the Defra official so that they had some idea but only a partial view. The impression I

got was that when they reported, they reported there and then; they gave them some principal findings and then they got the final version.

Mr Haworth: Yes. Let us go through this. In the first place I think, yes, we did at various levels in Defra firmly get the impression for a period of time that the report was going to conclude that there were circumstances in which a cull could be beneficial.

Q235 Chairman: But I have just clarified with Professor Woodroffe that there were circumstances, in the mechanical sense, of a relationship between culling badgers and a reduction in the incidence of bovine TB. She said that I had got that right. So that bit, no difference really.

Mr Haworth: Yes, but I think there is a difference of tone, which is probably why we used the word slanted. No-one is accusing anybody of being nobbled, but the impression given (and this has to be an impression, obviously, from the outside with imperfect knowledge) that at least the people who had seen earlier drafts of the report had got the impression that it was much more nuanced than it was, and that may be explicable by Professor Woodroffe’s observation that initially it had been written in scientific language and, in the end, it had been more written for the layman. That maybe the explanation. No-one is accusing an outsider of interference, but at some point it seems that the Secretary of State wrote to other Cabinet ministers announcing the fact that there was a likelihood, or probability, or possibility that there would be a cull, which must be a conclusion which was based on having read earlier drafts of the report. We are not saying that the report was nobbled by outside interference, but maybe, in the light of that, the authors of the report themselves were at pains to write the report in a way that would prevent the conclusion that had seemed to have been reached.

Mr Rowe: Could I add a slight qualified—

Q236 Patrick Hall: Could I just ask a question? I have not followed it all in great detail for several years, but there has been some recent comment in the press on 3 June in *The Sunday Times*, for example, flagging up that ministers are likely to allow a large-scale kill. The media does have a role to play in this country, it does not always mean, though, that the sources of its information are clear and unknown, and we can all suffer from this whatever walk of life we are in. Maybe what the media were saying is something that the NFU liked the sound of and is disappointed, but the real report is not what the media said. Is that not possible?

Mr Haworth: No, the report was never denied by anybody—that this letter had been written.

Q237 Chairman: I will tell you one thing, we have asked for it because I think it would be helpful for us all to know. So far we have had about one sentence from an alleged letter, and the sort of numerical bit of it does not quite stack up with all the evidence that has actually arrived. I do not know which version the Secretary of State is alleged to have seen and based

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this on. It is quite unusual that secretaries of state sit down and spontaneously write letters to Cabinet colleagues just because they thought, "I will just drop a note to the rest of the Cabinet and say, 'I am just browsing through a partial copy of an unfinished report, so I thought I would just write you a letter telling you what is what.'" So far we have had one sentence of a letter. We do not know what else it said. Do you?

Mr Rowe: No.

Q238 Chairman: No.

Mr Rowe: Could I slightly clarify where the sense of feeling comes from. All the way through this report there is a qualification which put over a lot of statements about "as in the culling done by the RBC method", and that is fairly constant throughout the report, and they qualify it, that all the data is from that particular method of culling. There are lots of other methods of culling that could be employed with greater degrees of efficiency and yet we have this absolute definitive statement: "Culling badgers will not work." I think that is where the confusion has come from.

Chairman: I will tell you what we will do, because there are one or two areas we want to move on to, and you have been very patient and we have extended this session because of Professor Woodroffe's fortuitous presence here. I think that we will analyse very carefully the reservations that you have had about the way in which the report was put together and I think that the Committee will be minded to do two things, one of which will be, with greater rigour, to play this back to the ISG as a whole to seek their observations, notwithstanding the very helpful comments from Professor Woodroffe, and secondly, and again you will be unsurprised to learn, I am sure, that this will form part of the basis of the questioning to a minister, once we get a minister, whichever that person may be, in front of us to find out where the Government have actually reached at whatever time we get hold of a minister. So, I want to move our questioning on and ask Mr Gray if he would take up future prospects.

Q239 Mr Gray: Let us imagine that the Government accept the recommendations on their face value and say, "Fine, no culling", what would the NFU advise people to do? There are really two parts to that. First, I remember back in 2006 the NFU said that, if that were to happen, there would be civil disobedience with regard to pre-movement testing and, secondly (rather than keep asking different questions perhaps you could answer them all at the same time), what would you say to farmers some of whom might conclude that if it is not going to be done officially they should do it themselves? In other words, this whole question of illegal culling. What would your advice to members be?

Mr Raymond: Obviously we would not advise any of our members to disobey the law. If there was a decision against culling, we would have to accept that, but I would put a proviso on that because there

is so much frustration at the moment. There is a determination within the farming industry that they want decisions, they want to move this debate forward, but I do fear for the industry, for the people involved in the industry, I return to the welfare of the farming families involved, and I just fear that, at the end of this, if people do not move this strategy forward, I can see a mass exodus from the livestock industry, particularly in the South West, particularly in the West Midlands and particularly in parts of Wales because I think people are at the end of their tether. I do not need to say to any of you the pressures that there are on the livestock industry, whether it is dairy farmers or even beef farmers at the moment; and this could well be the final nail in the coffin for those farmers because I think they have put up for many, many years with economic hardship with the pressures of restriction, and a lot of these people that I speak to have been waiting for a change of direction. If that is not forthcoming, I can see this exodus happening and I do fear for the infrastructure, for countryside management in certain parts of the country.

Q240 Mr Gray: One other thing about pre-movement testing which the NFU Council said they might interfere with if you did not.

Mr Haworth: No, we did not actually say that. The Council said that, unless the Government had a comprehensive TB eradication strategy, it would be difficult for us, perhaps impossible for us, to co-operate with the Animal Health Strategy the Government has got, which is not a matter of breaking the law, that is just a partnership approach that we have got with the Government, which we are anxious to pursue, we do not want to do that. We are also anxious to have a proper partnership and responsibility sharing agenda across the whole animal health sphere. If you look at our public evidence, that is what we have said, but if the Government is not prepared to act in partnership with us on TB, it will be very difficult for us to deliver the industry for the rest of the responsibility sharing, but there was never any threat not to participate or not to co-operate with pre-movement testing. That is the law.

Chairman: Roger, could we move to vaccines.

Q241 Mr Williams: Much has been hoped for in terms of developing vaccines, both for badgers and for cattle. When you read the report it does not seem desperately hopeful. I cannot remember the last couple of lines in the report relating to vaccines, but should Defra now put a deal of effort in terms of science and resources into supporting the development of a vaccine? After all, the cost to the country of TB is absolutely huge. Have you got any ideas perhaps about where we are in terms of developing a vaccine and any costs that could be incurred in making sure that that development is accelerated as much as possible?

Mr Raymond: We have advocated for many, many years the use of vaccines, the R&D around vaccination. I will hand this across. Point number six

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in our joint agreement with the rest of the industry states, “The industry and Government to work together to develop a strategy that would allow healthy badgers and cattle to co-exist post clearance. Full support to be given to the ongoing development of vaccines.” It is very much part of our plan, our priorities. What I find very sad about the vaccine debate is that, whenever I speak to people within that sphere, we keep getting told five to ten years, five to ten years, and I fear that the industry does not have that five to ten years at this stage. Again, we see the incidence level in the cattle population increasing, but as we see the hotspot areas develop and move outwards, there is no doubt in our mind that the wildlife has been contaminated, that disease is spreading and the longer it goes on the greater the problem is going to be. That is why we would suggest that we need action now rather than in five years’ time. Yes, vaccination, yes, develop the vaccines and we will support that whole-heartedly.

Q242 Mr Williams: It has been suggested to us that the problem is not one of technology of developing the vaccines but of taking the vaccine from the laboratory to use and all the regulatory hurdles that such a process would involve. Do we know anything?

Mr Rowe: I do not know in detail all the legislative procedures, but at the moment there is a trial going on very near to where I live, in fact, which is actually looking at the efficacy and the safety of an intradermally used vaccine using BCG.

Q243 Mr Williams: Is that with cattle or with badgers?

Mr Rowe: That is with badgers, and it is involving matched sets of badgers, some are rejected every year and some not, and comparing whether it has any effects, how long that effect lasts, whether it is safe in terms of other animals around. Provided you have got through that hurdle, and I believe David knows as much about it as I do, probably that is a three-year period that that is running over, of that sort of magnitude. One then has to go through the various legislative licensing procedures. There is also the fact that it has to be put into an oral form of bait which is protected so it will go through and work effectively within the badger. The Irish are doing some of this work. That is where this sort of eight to ten-year timescale comes in and then, fingers crossed, if it works, you then have to start applying it in the field, and, of course, its effect would not be immediate, it would take quite a lot of time to build up, which is why you are probably looking at nearer a 15-year timescale, even if everything goes to plan, before you get any beneficial effect in a large scale from a vaccine; and that is where we come back to Meurig’s point. The industry will have gone by then if we do not do something different now.

Q244 Mr Williams: There is the other problem, of course. If you use vaccination in cattle, how do you develop an appropriate test?

Mr Rowe: There is a lot of work. There are huge problems with even developing new vaccines for human beings. A lot of the cattle work is riding on the back of huge investments from pharmaceutical companies going into developing a TB vaccine, but it is a very strange disease to develop a vaccine for, and you have to be able to identify animals that have been vaccinated and infected and be able to say, no, it is one or the other. There are huge difficulties, but science is changing all the time. There are some amazing developments going on and that may be possible, but at the moment if the only vaccine they have available is BCG or variants of it, put that into a cow, you can no longer use the skin-test and nobody in the world would want any of our products or trade with us at all. It is not very effective in a cow, it might work with very young animals if it is used repeatedly, but, of course, as you say, you cannot then use them in any testing.

Q245 Chairman: One of the things that have intrigued me about Defra’s approach to this is that in all of their strategy documents they have produced these tables projecting the ever rising costs, and we are running anywhere between 80 and 90 million pounds a year. The only reaction so far from Defra has been the valuation issue, which has been aimed at reducing the amount of cost to responding to this. I find it very odd that in many areas of government activity spend to save is a regular part of the thesis. In the tax world they employ more inspectors to get more money in, but in this area there is almost a penny pinching. Just looking at the breakdown. Let me see if I can find the table in here. The cattle testing regime—this is the 2004–05 figures—was costed in a forecast figure around £36 million and the compensation figure was again £36 million. So, £72 million just on testing and compensating. I have not seen anybody say, “If we threw a shed load of cash in this, could we actually crack it?” Even if you said, let us take £100 million, one year’s cost, and throw that at vaccine, testing the whole lot, that is a huge budget, but if you do not do it this thing seems to have a life of its own. I do not understand. Perhaps you could help me. Why is it that Defra have not said spend to save?

Mr Raymond: Can I add to that as well? It is the cost on individual farmers and farmers under restriction, increased costs, increased cattle numbers, the cost of testing. Farmers have to carry the pre-movement test costs, so there are additional costs on the industry, on the individuals who can least afford it, on top of those figures that you have just quoted. If you follow through some of the recommendations on further cattle measures, I think we are going to see a huge increase in the costs. If you are going to roll gamma interferon out, I am led to believe that the cost of the skin-test is between five and six pounds per animal, whereas the cost of gamma interferon is about £75 per animal and, obviously, from a veterinary point of view, it is going to take a lot longer. The cost implications on the additional cattle measures are going to be fairly huge; so at

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some stage somebody is going to have to do the cost-benefit analysis on that, but I honestly do believe that if we are going to see a reduction, if we are going to reduce this graph that is constantly going upwards, then it is going to take a lot of resource and a lot of determination as well and a change in strategy.

Q246 Mr Drew: The point is that even the Irish with their much more favourable view towards culling, have stated (and I am not sure this is stated scientifically or this is a judgment) that the only answer is a vaccine. We all know where we are going, and obviously there is some interesting work being done in New Zealand at the moment. I do not know why there is not—. I think we actually know where plan B is now, and plan B was what we were actually calling for, it was effectively a subtext for vaccination, except that we are clear (at least I hope we are clear) as a select committee, it has got to be a badger vaccine rather than a cattle vaccine. Why do we not try and fight this? Why do we not all try together to get this and, for once, move forward and say it has got to be a vaccine and we have got to crack it sooner rather than later? I know what John Bourne said on Monday. He said science has to take its natural consequence, whatever actions you would want to have it take, but there must be some logic in that argument.

Mr Rowe: I totally agree with you, and this shed load of money should have been spent 15 years ago, but it has not been and I am not sure a shed load of money would actually make much difference to the speed a vaccine would develop. It might help a little, but I do

not think it would help a lot. I think we are quite a long way down the road towards an effective vaccine, but there are a number of hurdles that have to be jumped, and they all take time and money is not necessarily going to speed that up. I wish it would and if there was a way it would, let us look at it.

Q247 Chairman: Thank you very much indeed. Thank you for your forbearance at the slightly unusual nature of our proceedings, but I think it was to our advantage to have the benefit of a special tourist giving us the benefit of her views. May I thank, again, Professor Woodroffe for her contribution. Can I thank our earlier witnesses and may I again reiterate our thanks to the NFU. You will gather that the Committee perhaps have got themselves into a slightly bigger area for further inquiry and questioning than we perhaps realised. I think we had all hoped that we might be getting somewhere towards the development of an alternative strategy and I suspect that we will all still be scratching our heads for the foreseeable future. Anyway, we have much to reflect upon. Thank you very much for coming and giving evidence to us this afternoon.

Mr Raymond: Can I thank you, Chairman, and the Select Committee, and can I hand this across. It is the seven-point plan.

Chairman: Thank you very much. We will ensure that all members of the Committee get a copy of it. Could I ask colleagues to stay behind for a couple of minutes for reflection afterwards, but if members of the public would be kind enough to vacate the room, we would be most grateful.

Memorandum submitted by the Independent Scientific Group on Cattle TB

Thank you for your letter of 28 June inviting me to submit further evidence in the light of that given by the National Farmers' Union on 20 June 2007 and on other matters relating to the Final Report of the Independent Scientific Group on Cattle TB (ISG).

You are, of course, aware that the ISG was dissolved on 30 June,² thus I am no longer Chairman of the Group. However, the content of this letter has been agreed by all former members and is being sent with their approval.

I will deal with the Report first. On 23 May we sent Defra Ministers a near-to-final draft of our Final Report, comprising what was eventually published as Chapters 1 to 7 inclusive, 9 and 10. Between 2 and 18 May we had been sending various draft chapters to Defra officials for comment, and to enable them to fine-tune in advance any Ministerial briefing that they may have felt was appropriate.

As a scientific document the report was based mainly on scientific publications, the majority of which were already in the public domain. All ISG publications were prepared in consultation with Defra policy and scientific advisors, the majority included Defra scientists as co-authors, and Ministers received copies of the papers at the time of submission to scientific journals.

Draft copies of the Chairman's Overview (comprising the commentary of progress and list of acknowledgements) and the Summary of Scientific Findings (a brief summary of Chapter 10), were not seen, as far as I am aware, by Defra Ministers before an advance copy of the printed version was hand delivered to their respective offices on the morning of 15 June 2007.

Having read the uncorrected transcript of the evidence given on 20 June 2007 I must say how very disappointed I am by some of the inappropriate and unfounded comments directed towards the ISG and our report, particularly those suggesting that the "... report has been slanted at the last moment ... " (NFU

² The Independent Scientific Group on Cattle TB was formally dissolved on 30 June 2007.

response to question 202). Comments of this nature have no place in the public record, and I am grateful to your Chairman for providing Professor Rosie Woodroffe with an opportunity to respond to them at the time. I do of course support everything that Rosie said in evidence.

But I would like to take this opportunity to add to that and to set out in a little more detail what was reported to Ministers in the intervening period between our early 2006 comments on Defra's badger culling consultation and the publication of our Final Report.

On 24 April 2006 Christl Donnelly, Rosie Woodroffe and I met Defra Minister Ben Bradshaw. Defra officials were also present. A number of issues were discussed at that meeting, but I have set out below a number of the key points made by the ISG at the time which were relevant in particular to our position in relation to badger culling then, and which are relevant to our subsequent Final Report conclusions:

- There was widespread scientific agreement on the detrimental impacts of localised culling;
- To be effective, any cull would need to be delivered in a co-ordinated and efficient manner for a sustained period of time over a large area that was isolated by features such as major rivers, roads or coastline (to avoid the detrimental edge effect caused by badger immigration);
- By extrapolating from the RBCT results, Defra's Science Advisory Council had suggested that culling over an area of 300km² might bring benefits, but we recommended that this might need to be a minimum, and that in our experience sustained and comprehensive coverage of such extensive areas would be difficult to achieve; and,
- In our opinion more could be achieved in terms of cattle TB control by focusing on measures other than badger culling, and that a quick reduction in TB herd incidence could be achieved by focusing on the cattle element.

A copy of a note of this meeting, prepared at the time by the ISG Secretariat and circulated to ISG members, is attached for information and clarity (Annex A). However, to ensure that the proper information release protocols are maintained and, most importantly, personal security is protected, the names of the Defra policy officials present have been removed.

On 29 November 2006 I attended a further meeting with Ben Bradshaw. The main and relevant points I made at that meeting were:

- Localised culling made things worse and proactive culling over 100km² had effectively a zero impact;
- If a badger culling policy was to have a positive effect on reducing cattle tuberculosis, such culling would have to be on a large scale, far larger than in the RBCT, and done systematically involving professional expertise, for a long time. Elimination or near elimination of badgers could maximise the impact of culling;
- The debate with the NFU and veterinary profession should be shifted away from badger culling to improved cattle controls; and,
- In response to comments from Defra officials that there could be a modest gain in tuberculosis control if a culled area was as large as 300km², I said there would be winners and losers, but extrapolation of trial data suggested that overall there would only be modest positive gains. Further, I emphasised that if culling was conducted in a patchwork and inconsistent way it was likely to make matters worse.

A copy of a note of this meeting, prepared at the time by the ISG Secretariat and circulated to ISG members, is attached (Annex B). In the near future this will be made available as a public document, as part of the archiving and public release of the ISG's papers but, for the same reasons given above, the names of the Defra policy officials present have been removed from this copy.

There was one further meeting, held on 1 February 2007 when David Miliband and Ben Bradshaw met Christl Donnelly and me. This was a private meeting and no formal note was taken by the ISG. We repeated the discussion previously held with Mr Bradshaw at the November 2006 meeting, taking the opportunity to provide an update of research progress. In the main we discussed two issues: the value and feasibility of a large scale cull over an area of 300 km², and the option for cattle measures as the focus for future bovine TB control.

It is clear that our views and advice on the impact of badger culling, as conducted in the Randomised Badger Culling Trial, have been consistent ever since data became available on the effects of proactive culling. These views consolidated as more ecological and epidemiological data became available for analysis and some economic evaluation was undertaken, providing further insights that allowed extrapolation to alternative forms of culling. Nevertheless, the foregoing evidence confirms that at no time since relevant data became available has the ISG changed its opinion—or the tone of its advice to Ministers—concerning the impact badger culling would have on bovine TB incidence, and the role that such culling could play in bovine TB control.

Finally, I remain to be convinced that the comments about the ISG and their conclusions can be fully and satisfactorily addressed through correspondence alone. I am therefore grateful for the opportunity kindly offered to me to attend a further evidence session on 24 October 2007; this will enable me to publicly refute the 20 June allegations and to elaborate on the detail in this written evidence.

Professor John Bourne CBE
July 2007

Annex A

Note of a Meeting with Ben Bradshaw MP, Minister for Local Environment, Marine and Animal Welfare, held on Monday 24 April 2006

The meeting was held to enable an update and discussion on current TB policy developments and on the ISG's presently available scientific evidence. This note provides a summary of the key points discussed.

In Attendance

Ben Bradshaw MP	
Professor John Bourne	xxx, Defra
Professor Christl Donnelly	xxx, Defra
Dr Rosie Woodroffe	xxx, Defra
Mike Summerskill, ISG Secretary	PS/Ben Bradshaw

Badger Culling Consultation

Professor Bourne confirmed the ISG's disappointment that the consultation ignored much of their scientific evidence, and that it did not fully reflect the ISG's representations made to the Minister and his officials prior to publication. The ISG had felt it painful but obligatory for them to subsequently write to the Minister clarifying the scientific findings. The ISG commented that aspects of the science need resolution, but they did not believe that aspects of the proposals in the consultation were either feasible or tenable. The Minister said he was content with the way the consultation document presented the evidence, asking the ISG to understand that any upset that may have been caused was not intentional.

Professor Bourne asked the Minister to note that between the mid 1970's and 1990's badger removal policies, based on extended but localised badger culling over areas up to 10km², had no impact on the rising national trend of bovine TB incidence. Evidence from the reactive element of the RBCT demonstrated that localised culling benefited an individual farmer, but made no impact on national trends and indeed made matters worse.

Professor Bourne confirmed that the RoI Four Areas Trial has helped the ISG interpret its own data, despite differences in the culling method, badger density, landscape and geography and compliance. He said Thornbury could not be produced in a national context, because it required prolonged culling by gassing over a 7-year period, and was conducted in a geographically isolated area, and asked the Minister to note that the RBCT results for TB incidence within proactively culled areas were very similar to those that emerged from the East Offaly trial.

Professor Bourne said that there was widespread scientific agreement on the detrimental impacts of localised culling and re-iterated the ISG's view that to be effective, a cull would need to be delivered in a co-ordinated manner over a large area, for a sustained period of time, and would need to be efficient. Professor Bourne pointed out that badger removal in the RBCT had been high and substantial, and that—acknowledging that this was an extrapolation from British and Irish studies—the ISG doubted if improved badger removal rates would reduce cattle TB incidence appreciably more than the RBCT had achieved.

Perturbation, the Edge Effect and RBCT Efficiency

Professor Bourne said that the scientific community agreed with the principle of the ISG's finding regarding perturbation. This included the Royal Society and all of the independent scientists who attended a January meeting with Howard Dalton, as well as the EFRA Select Committee. Dr Woodroffe explained the hypothesis for badger movements and perturbation related to culling, and confirmed that if a drastic reduction in local badger population was achieved in a culling area—more than the RBCT achieved—this could further reduce the contact rate between badgers, and between badgers and cattle, and that this might lead to an incremental reduction in cattle TB incidence inside the culled area. However, she cautioned that immigration of badgers was inevitable unless the area to be culled was isolated by features such as major rivers, roads, or coastline, and hence a detrimental edge effect, like that seen in the RBCT, was to be expected.

In response to a question from the Minister about whether it was possible to compare rates of badger removal between the RBCT and other trials, particularly in RoI, Professor Bourne explained that it is very difficult to give certainty on the exact removal rates in any culling exercise. Professor Donnelly urged caution

in making direct comparisons between culling trials in different countries because the underlying proportion of TB infections in cattle arising from badgers is likely to differ, meaning that similar culling policies would have different impacts on TB incidence in cattle. Dr Woodroffe pointed out that geographical isolation was an important component in the efficiency of the RoI Four Areas trial as this impeded badger immigration.

Professors Donnelly and Bourne confirmed that the ISG was working with CSL to arrive at a more robust culling efficiency figure for the RBCT, pointing out that the 20–60% efficiency figure quoted by Defra and Ministers was without scientific basis, and unhelpful. They said that CSL staff had now suggested that the RBCT had achieved 50–80% removal of badgers after the first proactive cull. Professor Bourne commented that, while this figure was subjective (since it was not possible to obtain an accurate figure for trapping efficiency) the latest CSL estimate was consistent with the view of the independent ecological assessment that badger numbers had been substantially and consistently reduced in proactive areas as a result of continued systematic culling.

The Minister asked about the balance of benefit, ie would more intensive culling, possibly using different methods to the RBCT, reduce the edge effect by removing more badgers and thus limiting disease incidence in the periphery of the culled area? Dr Woodroffe said the answer was unknown, but it was assumed that any changes in the balance would depend on the size of the area culled. She confirmed, however, that this would require significant reduction in badger densities over a large area and in a sustained and controlled manner.

Dr Woodroffe said there were a number of issues to be resolved regarding the edge effect and perturbation, but confirmed that the ISG was working on some analyses, which they would make available as soon as possible.

Area to be Culled

The Minister asked about the scientific basis for calls for a culling area to be at least 300 km², and whether there was a trade-off between the size of area and the level of badger removal. Professor Donnelly explained that by extrapolating from the RBCT results, Defra's Science Advisory Council had suggested that 300 km² might bring benefits, but the ISG might recommend this as a minimum, and opt for a larger area. As for a trade-off, Professor Donnelly said that a simple analysis suggested that as the inner culled area (more than 2 km from the boundary) expanded, the benefit improved, but this would require sustained effort and comprehensive coverage. ISG members warned, however, that their experience in overseeing the RBCT indicated that culling over such extensive areas would be very difficult to achieve.

A state cull?

The Minister asked why the ISG appeared to be sceptical of any cull other than one implemented by the state. Professor Bourne said it would be wrong for the Minister to underestimate the expertise of Defra's Wildlife Unit staff. He said farmers did not have that level of expertise and could not be relied upon to work equally efficiently or effectively, over a long period of time. Professor Bourne said any cull would need to be systematic and co-ordinated by a skilled workforce over a long period of time—if a cull was patchy it would not work. Professor Bourne also asked the Minister to note that the majority of farms in high incidence areas do not get TB, and many of those farms see badgers as protective.

xxx outlined the main culling options in the consultation, and explained that a cost and benefit analysis did not support a state run cull. Collectively, the ISG said that although this might be the case, the other options were not supported by the science, would have no positive impact and would make matters worse, adding that, clearly, any policy without a positive benefit could not be cost-effective in any sense. It was the opinion of the ISG that more could be achieved, in terms of cattle TB control, by focusing on measures other than badger culling.

Testing

Professor Bourne said that there was clear evidence that the tuberculin skin test has limitations, which is why the ISG had been calling for greater use of gamma interferon, as a complementary test, for a number of years.

Professor Bourne said a recent finding that 85% of cattle are not tested in their lifetime suggests the testing regime needed tightening, and that to achieve this (in part) pre-movement testing required policing if it was to be effective. He added that at the moment too many undetected infected animals remained in the national herd resulting in the geographical movement of the disease into new areas of the country and contributing to persistence of disease in infected areas. The meeting noted that Defra officials were to discuss gamma interferon with stakeholders, and with the ISG later in the week.

The meeting briefly discussed the PCR technique, with the ISG advising caution on the recent results and announcements emanating from Warwick University. The ISG pointed out that even if the test was validated (ie shown to be both sensitive and specific), any localised culling policy prompted by positive PCR results would be expected not to yield benefits and could make TB incidence worse. Professor Bourne agreed to send further details to the Minister.

What would the ISG do?

The Minister asked what the ISG would do, when presented with the current situation of increasing TB trends.

Professor Bourne said it would take many years for badger culling to be effective if carried out efficiently over large areas. Therefore, a quick reduction in TB herd incidence could be achieved by focussing on the cattle element, but this would require farmer co-operation, as Defra cannot tackle this disease alone. He added that there are a significant number of problem herds that should not be trading, which should be treated aggressively. Professor Bourne pointed to the success in reducing TB incidence in New Zealand and N. Ireland, achieved through improved diagnostics and herd control measures.

Dr Woodroffe said that the badger TB reservoir would remain, however, and that the science supported the notion that culling would make the situation worse. The Minister said that, unfortunately, the Government did not have farmer co-operation, and this was less likely if the badger issue was not addressed. The ISG said this was the conundrum that Government had to resolve but cautioned that culling was unlikely to achieve control. Ongoing analyses by ISG should further inform this issue and will be presented to Ministers shortly.

Chief Scientific Adviser

The Minister said that it would be beneficial for the Government's Chief Scientific Adviser, Sir David King, to be fully informed of the science behind the ISG's analyses, and that the ISG should meet Sir David at the earliest opportunity. The Minister had already recommended to the Secretary of State that such a meeting should take place. The ISG confirmed that Sir David had not been in touch, so the ISG Secretariat agreed to initiate a meeting.

Concluding the meeting, the Minister said that a quick decision on the policy options might not be possible, although clear actions would need to be apparent fairly rapidly. A further meeting with the ISG in June/July 2006 was not ruled out.

ISG Secretariat

May 2006

Annex B

Note of a Meeting between Minister of State (Ben Bradshaw) and Group Chair (John Bourne)

PRESENT

Minister of State
Mr Ben Bradshaw (and his private Secretary)

ISG	Defra
Professor John Bourne (Chairman)	xxx
Dr Alan Patey (Note Taker)	xxx

1. Mr Bradshaw welcomed Professor Bourne and asked how the ISG was progressing its work. Professor Bourne said that it had, at times, been a difficult 9 months although it was also encouraging that Field Trial data were showing that its design criteria had been met and that the outcome of the Field Trial was soundly based. The difficulties arose from the ISG and the RBCT being subjected to a large amount of unwarranted criticism, much of it extremely personal in nature. He believed that a great deal of this was because of the misinformation on RBCT culling efficiency (ie 20–60% effective) promulgated by Defra last year in its public consultation document on badger culling, and the answer given to a Parliamentary Question on RBCT trap interference. Although the latter was accurate in the data it presented, it gave the impression, in the way it was worded, that trap interference had seriously damaged the RBCT, which it had not.

2. In answer to questions from Mr Bradshaw on where the erroneous set of figures had originated and had these matters now been resolved, Professor Bourne said that he was very pleased that the Minister had wished to counter such criticism, eg in his rebuttal letter to the Secretary (Dr L Thomas) of the Veterinary Association for Wildlife Management. The origin of these figures had been described in the minutes of the May ISG Meeting. These represented an attempt by CSL to provide data for use in their economic model and were not intended as a reliable or true measure of trapping efficiency in the RBCT, and related solely

to the first cull in Proactive Areas. There was now evidence that culling efficiency was much higher and about 75% of badgers had been removed from RBCT Areas over the course of the Trial as reported in two papers, in preparation, one from CSL and one from the ISG.

3. Stressing recent progress, Professor Bourne said it was reassuring that the design criteria of the RBCT had been entirely met and the quality of data obtained from it was assured. He said that his Group were presently actively involved in the production of scientific papers describing the Trial and related research and highlighted the forthcoming trapping efficiency and pathology papers. In answer to a question from Mr Bradshaw, Professor Bourne said that the trapping efficiency paper should be forwarded to Defra in the following few days prior to submission for publication.

4. Professor Bourne said that Trial findings were scientifically soundly-based, localised culling made things worse and Proactive culling over 100 km² had a zero impact. However extrapolation of Trial data was raising uncertainties. It has been suggested that if a badger culling policy was to have a positive effect of reducing cattle tuberculosis, such culling would have to be on a large scale, far larger than in the RBCT, and done systematically for a long time. Two questions had been raised. If culling efficiency was increased would this have a greater positive impact and also would this reduce the edge effect. The answer to both questions was probably no. Asked by Mr Bradshaw to expand on this statement, Professor Bourne said that models had shown that if culling efficiency of 90% had been possible in the RBCT, this level would have had only a limited further impact on TB reduction recorded in the RBCT. With respect to the edge effect, the problem was uncultured badgers, both within and particularly outside culled areas. Professor Bourne said that there was a consistency of findings from badger removal in the 1970's and 1980's, the ROI and the RBCT, in that only elimination or near elimination of badgers could maximise the impact of culling. Localised culling made matters worse.

5. Prompted by Mr Bradshaw to consider possible badger culling by farmers, Professor Bourne said that such culling would not be systematic, there would be access to land problems and he doubted if all but a few farmers had the persistence to carry out such operations. However, he believed that more and more farmers were beginning to appreciate the findings of the ISG and now recognised the value of biosecurity measures and cattle controls and felt that it would be helpful if Defra supported the Trial findings and attempted to shift the debate with the NFU and veterinary profession, in particular, away from badger culling to improved cattle controls. An interesting and important finding in ROI and the RBCT was the very small numbers of infected badgers on the ground (1 per 4–5 km², or fewer in ROI) that were responsible for cattle breakdowns, again suggesting that near to elimination was necessary.

6. Professor Bourne asked xxx and xxx if they disagreed with any of the statements he had made. xxx said that s/he agreed entirely, but opined that there could be a modest gain in tuberculosis control if a culled area was as large as 300 km². Professor Bourne said that there would be winners (farmers in the area but away from the edges) and losers (farmers adjacent to the area), but extrapolation of Trial data suggested that overall there would only be modest positive gains, and if farmers culled in a patchwork and inconsistent way it was likely to make matters worse. xxx said that Defra would have to consider the granting of a culling licence if one was applied for an area of such a size and a refusal to issue one would need proper justification. Professor Bourne said that data from the RBCT would allow justification for refusal. Mr Bradshaw said that the ISG might have to defend their position in a court of law.

7. In answer to a question from Mr Bradshaw on any further areas that should be brought to his attention, Professor Bourne said that the ISG had now started spatial analysis, but there was nothing to report at present and reiterated papers in preparation. Sir David Cox was considering the possible modelling of a rigid focus on cattle controls. xxx asked if this would be on a National or Regional basis and Professor Bourne said he would ask Sir David Cox for this information. xxx opined that this would relate simply to high incidence areas.

8. In answer to a further question from Mr Bradshaw on the timing of the ISG's final Report, Professor Bourne said that he hoped this extensive document would be ready by next Easter and it could include the cattle control model, if it was possible to do.

9. The Minister thanked Professor Bourne for his advice and asked he pass his thanks to the other Members of his Group.

ISG Secretariat

December 2006

Memorandum submitted by the Badger Trust

EXECUTIVE SUMMARY

1. The Badger Trust welcomes this invitation to present written evidence to the Environment, Food and Rural Affairs Select Committee. There is now a greater body of sound scientific evidence about the epidemiology of bovine TB than ever before. We hope that the Committee will base its recommendations on this sound science, much of which has been published in the world's leading peer-reviewed journals[1-3].

2. The Badger Trust seeks constructive, positive solutions to the problem of bovine TB, all of which must be based on sound science. We support the Independent Scientific Group's conclusion that badger culling cannot make a "meaningful contribution" to bovine TB control.

3. Instead, the science makes it clear that it is perfectly possible to bring bovine TB under control using cattle-based measures alone, such as gamma interferon TB testing and whole herd slaughter for problem herds.

4. It is imperative that a badger cull is not offered to farmers as a political *quid pro quo* for implementing the strong, cattle-based TB control measures that the science shows are required. There is speculative evidence that this is Lord Rooker's intention.

5. We make the following recommendations:

6. *Recommendation 1:* The establishment of an Epidemiology Research Unit that is fully independent of Animal Health. It will use lay staff under the supervision of independent scientists to gather useful epidemiological data to support the battle against bovine TB—and potentially against other diseases, too.

7. *Recommendation 2:* The Government should appoint an independent scientific panel to ensure that new TB policies are based on sound science and, crucially, that the benefits of the policies are properly monitored after their introduction.

8. *Recommendation 3:* The Government should establish an incentive system for people involved in the slaughter and inspection of cattle and deer, to maximise the reporting of suspicious lesions.

9. *Recommendation 4:* The Government should: introduce annual bovine TB testing across England; whole herd slaughter for problem herds; urgently review the progress of gamma interferon testing and upgrade laboratory facilities accordingly; and, improve the use of resources by involving trained lay personnel rather than vets in bovine TB testing.

10. The Badger Trust accepts the scientific findings of the ISG and notes that the ISG has provided scientific and economic arguments, which eliminate the culling proposals advocated by farming unions.

11. We advocate the urgent introduction of a case-control study to assess the benefits of taking steps to keep badgers out of farm buildings.

INTRODUCTION

12. The Badger Trust welcomed the invitation from the Committee Chairman, the Right Honourable Michael Jack MP, to present further written information, if we wished, in the wake of our appearance before the Select Committee on 20 June 2007. In this submission, we provide additional evidence that we hope the Committee will find useful.

13. There is now a greater body of sound scientific evidence about the epidemiology of bovine TB than ever before. We hope that the Committee will base its recommendations on the sound science which has been published in the world's leading peer-reviewed journals[1-3]. If bovine TB is to be effectively controlled, it is essential to avoid policies based on speculative and intellectually weak "what if?" interpretations of the science, made by state vets rather than by independent scientists.

14. The Badger Trust provides centralised, specialist scientific, legal and communications advice to badger groups. It also liaises with relevant organisations across the UK and Ireland. Its partners include the many land-owning nature conservation organisations that have recognised that badger culling cannot make a meaningful contribution to controlling bovine TB, including: the National Trust, the RSPB, the Wildlife Trusts and the Woodland Trust.

15. The Badger Trust seeks constructive, positive solutions to the problem of bovine TB, all of which must be based on sound science. We support the Independent Scientific Group's conclusion that badger culling cannot make a "meaningful contribution" to bovine TB control. We hope that the Select Committee will acknowledge that badgers are a protected species and that the UK is a stronghold for this species in the EU. Taken together, these two arguments mean that demands from farming unions for the extermination of badgers in substantial areas of the UK are, at any scale, scientifically, politically and economically unacceptable. These demands must be rejected.

16. Instead, the science makes it clear that it is perfectly possible to bring bovine TB under control using cattle-based measures alone, such as gamma interferon TB testing and whole herd slaughter for problem herds. The question that the Select Committee needs to answer, we suggest, is the extent to which taxpayers should be expected to help farmers implement such measures.

17. It is imperative that a badger cull is not offered to farmers as a political *quid pro quo* for implementing and paying for the strong, cattle-based TB control measures that the science shows are required. At this stage, the Badger Trust very much fears that the *quid pro quo* is exactly what Lord Rooker, in whose hands the decision rests, is inclined to offer.

18. The Farmers Guardian, for example which likes to give the impression that it has direct contact with Lord Rooker, today reports: “Although Food and Farming Minister Lord Rooker does not share the ISG’s views on the futility of badger culling, Defra has made it clear that farmers would have to accept some form of enhanced cattle controls in exchange for the licensed culling policy he wants to introduce.[4]”

19. Such a decision will not be based on sound science but on cheap politics.

20. The Government stands at a crossroads in bovine TB policy. It has the choice to help farmers address not only bovine TB but also a wider range of farm animal health and welfare objectives, with carefully targeted funding aimed at reducing the transmission between infected animals. This would be a sustainable, win-win approach, helping to improve the economic viability of farming without alienating the wider public who are prepared to support farmers, but not at any cost. Alternatively, the Government could permit a futile, vindictive campaign of badger killing which will make the disease situation worse and alienate farmers in the eyes of the public, whilst handing farmers the total financial burden for other bovine TB measures.

21. We prefer the former option and, in this document, the Badger Trust offers positive solutions that will help to address the problem of bovine TB in a sustainable way.

RESPONDING TO THE SELECT COMMITTEE

A. Ministers, state vets and scientists

22. David Taylor MP commented: “You said that [the Minister] would be in a science vacuum at the mercy of state vets, as if he is some poor, simple sap baffled by scientists with a hidden agenda.”

23. Whilst the Badger Trust would not go so far as to describe any Minister as a “simple sap”, we have been deeply worried by the fact that a succession of Ministers has spent a great deal of time listening to state vets’ interpretation of the ISG’s research, rather than listening to the ISG itself.

24. The Select Committee will be aware from its previous hearings in 2005 that the Government launched its consultation on badger culling without taking advice from the ISG. When the Badger Trust Cymru and the Badger Trust recently met ISG chairman Professor Bourne, when giving evidence to the Rural Development Sub-Committee at the Welsh Assembly on 20 September, we were astonished to learn that Lord Rooker had still not met the ISG.

25. We feel that this is a shameful dereliction of duty by the Minister. Tax payers have invested in excess of £50 million in the work of the ISG and, at the very least, Lord Rooker should have taken the time to discuss with the ISG any uncertainties that he may have about their research. He should have done this early on, given the pressing nature of the bovine TB problem.

26. More recently, Lord Rooker has indicated to us that it is not for him to accept or reject the recommendations of the ISG. We disagree. It is exactly the role of Ministers to make clear decisions about the validity of the advice that they receive and that tax payers have paid for. We believe that it should be relatively easy for Lord Rooker to accept the ISG’s findings, given that they have been subject to very robust peer review at the highest international level. The failure of Lord Rooker and his predecessor to do so begs the question: why?

27. We believe that the answer lies in the policy-making structure of Defra. Despite being renamed in the wake of the foot and mouth disease fiasco of 2001, the Department’s policies with regard to animal health and welfare are still driven by state vets, with scientific advice very much on the sidelines.

28. We have seen consistent evidence of civil servants undermining the work of the ISG. This is apparent in the minutes of the ISG[5] and the erosion of scientific expertise, by civil servants, continues. During a recent meeting with Lord Rooker, for example, a senior member of Defra’s TB unit defended Professor Simon More’s critique[6] of the ISG’s work, insisting that the critique had been peer-reviewed. The Veterinary Record has told the Badger Trust that Opinion pieces are not normally peer-reviewed and the RSPCA has stated, as a matter of fact, that this Opinion was not peer-reviewed[7].

29. More significantly, however, is not where More’s critique has been published, but where it has not. On 10 October, at a seminar organised by Ireland’s Department for Agriculture, Professor More confirmed in response to a question from the Badger Trust that the critique had been submitted to Nature, where the ISG’s results were first published. Nature had declined to publish the submission, following peer review.

30. We find it perverse, to put it mildly, that Defra officials are actively involved in undermining research of the highest quality and commissioned by Defra itself, particularly when the research has been published in journals of the highest international standing.

31. In conclusion, we believe that whilst Ministers must make clear decisions about future strategies for bovine TB control, those decisions must be expressly supported by genuinely-independent scientific experts. Defra's Science Advisory Council has provided an excellent model suggesting how such a system might work. Yet to the best of our knowledge, the Minister has done nothing to implement it.

32. David Taylor MP also suggested that in criticising Animal Health (formerly the State Veterinary Service) we were passing a verdict without a trial. In fact, our report on Animal Health contained a detailed analysis that fully supported our primary conclusion: namely, that claims made by State Vets about badgers as a cause of bovine TB—either on a farm basis or regionally—are not supported by valid epidemiological evidence. More details are given in Appendix A.

33. In July 2007, Defra effectively confirmed the Badger Trust's lead finding. It published research that has been in the Government's possession since 2000. The research included a review, by the Veterinary Laboratories Agency, of the qualitative information gathered by TB49[8]. TB49 was the questionnaire used by state vets to document TB outbreaks between 1986 and 1998. It was the only source of evidence available to state vets on the epidemiology of bovine TB.

34. Yet the researchers found 'a minimum quality standard in operation' with regard to completion of the forms and concluded that "TB49 is not adequate for use in detailed epidemiological analysis of risk factors for bovine tuberculosis". In short, the data gathered by state vets up to the end of 1998 could not be used to explain the causes of bovine TB cases or to explain the spread and persistence of the disease.

35. Since 1998, there has been no consistent strategy to ensure that useful epidemiological data on the causes of bovine TB is gathered. This leads to a serious problem at farm and regional level. State vets routinely tell farmers that badgers are the likely cause of a TB breakdown, when in fact they lack the level of information required to pass such a judgment. Farmers, not surprisingly, get angry and frustrated, and this fuels the pressure on Ministers to kill badgers.

36. Thus, it remains our position that state vets cannot be relied upon to provide Ministers with sufficiently robust scientific or epidemiological advice. Yet within the corridors of Defra, state vets rather than scientists take a primary role in influencing policy and they have the ear of the Minister.

37. We urge members of the Select Committee to read our report on Animal Health which has been submitted to the Committee and is available on our website at www.badgertrust.org.uk

B. *Bovine TB in Ireland*

38. Sir Peter Soulsby MP asked why, in our estimation, Ireland's Agriculture Minister—Mary Coughlan—was wrong to defend the role played by badger culling in controlling bovine TB in Ireland.

39. In Appendix B, we provide a graph that details the recent history of badger culling in Ireland. What is clear from this graph is that whilst badger culling has been consistently practised for decades, bovine TB levels have soared and fallen independently of the killing strategy. Instead, rather more clear parallels can be seen with shifts in cattle testing policy.

40. A further important point to be drawn from our graph is the more recent situation. Far from showing a sustained drop in bovine TB, the number of slaughtered reactors in the Irish national herd has been stable for the last three years, despite continued badger culling.

41. A key question which the Irish researchers are currently unable to answer is this: Why is it that bovine TB strains are clustered in cattle herds, but are not clustered in badgers within two or even five kilometres of those herds?[9, 10]

42. We believe that the persistence of bovine TB in the Irish national herd is the result of localised cattle movements in a patchwork of fields, none of which are double-fenced, leading to cyclical infection amongst herds. Ireland's surviving badger population, meanwhile, is so perturbed that animals roam very widely, acquiring different bovine TB strains from different clusters of infected cattle.

43. We respectfully ask the Select Committee to ask the Minister why it is that Defra officials (who attended the seminar in Ireland) place so much weight on findings in Ireland, even though they do not remotely approach the scientific robustness of the findings of the ISG in England.

44. Reliable data from Ireland is sparse at the best of times, but two things are clear: twice the proportion of the national herd in Ireland is slaughtered with bovine TB compared to Britain; and, nowhere in Ireland's major centres of disease has bovine TB been eradicated. Furthermore, bovine TB declines in Northern Ireland—where there is no culling but where controls on cattle have been tightened—match those in the Republic of Ireland, suggesting that cattle controls are the instrumental factor.

C. Badger welfare

45. Patrick Hall MP asked about the implications of bovine TB for badger welfare. We would like to stress three points.

46. First, bovine TB in badgers is not a significant cause of death, as indicated by long-term research at Woodchester Park[11].

47. Second, in paragraph 4.25 the ISG's report[12] notes that "the number of such severely lesioned infected badgers was very low (only 166 animals out of 9,919 scored in 1998–2005, Jenkins *et al*, in review-a; Woodroffe *et al*, in review)". That only 1.67% of badgers were severely lesioned strongly suggests that bovine TB is not a significant cause of suffering to badgers. Woodchester park research has found that badgers with TB live and breed normally for many years, with no sign of ill-effects[11].

48. Third, and most importantly, the fact that a minority of badgers suffer from bovine TB does not, ethically, justify killing them when they are infected but not sick. It certainly does not justify killing the vast majority of badgers that are perfectly healthy and unaffected by the disease, as would be the consequence of any culling policy.

D. Bovine TB at the local level

49. In responding to question 181 from Patrick Hall MP, the Badger Trust made the point that when bovine TB maps are looked at in detail, even in parishes subject to annual testing the majority of farms are not affected by bovine TB. We noticed one or two Committee members appearing to disagree with this statement. But it is vital that its significance is grasped and understood.

50. Bovine TB maps published by Defra suggest that vast swathes of the countryside are under bovine TB restriction. In fact, this is not true. Defra's map shows parishes subject to TB testing, but within those parishes the majority of farms are rarely affected. This is important, because it means that in most parishes the majority of farmers have nothing to gain from a badger cull and indeed they have more to lose, because it puts them at greater risk of acquiring the disease.

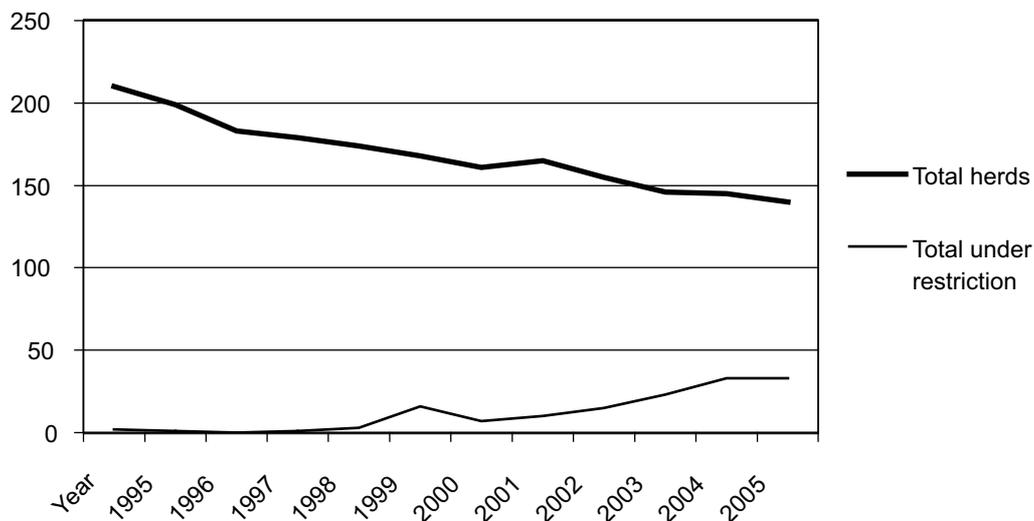
51. We understand that the Select Committee visited Devon on 18 October to meet farmers and vets. It is unfortunate that the Committee was unable to find time to meet those who do not advocate badger culling as a means to control bovine TB. But now that Members are familiar with the lie of the land, this provides us with an opportunity to illustrate the huge dangers posed by a badger culling policy.

52. Our example centres on the parish of Beaworthy in West Devon, where local farmer Bryan Hill has long claimed that a policy of killing "sick badgers", adopted by himself and colleagues, has kept the parish "99%" free of TB[13]. Unfortunately, these claims do not stand up to scrutiny.

53. The following graph, using data provided by Animal Health, shows what has actually happened in Beaworthy and the parishes immediately adjacent to it (Ashbury, Bratton Clovelly, Halwill, Northlew, Okehampton and Sourton). If Mr Hill and his friends have indeed been killing badgers, then either they have had no effect (since the general upward trend in bovine TB is the same nationally). Alternatively, if illegal killing is taking place nationally, then it might be argued that farmers are generally making matters worse. Either way, the statistics do not present an argument for killing badgers.

54.

TB incidence in and around Beaworthy 1995-2006



55. The first important factor to note is the declining number of herds. This does not mean that land is no longer grazed. Instead, farmers who continue to manage livestock are now grazing their cattle on land that formerly held cattle from other herds. If the land is registered under a single holding, Animal Health will have no records to show that the livestock have been moving ten or 15 miles away to graze and, possibly, coming into contact with another herd.

56. The second important factor is that even in these parishes, where a minority of farmers demand the right to kill badgers, the vast majority of herds are not under bovine TB restriction. Those under restriction are very much the minority. A badger culling policy, by triggering increased perturbation, would put the majority of herds at risk.

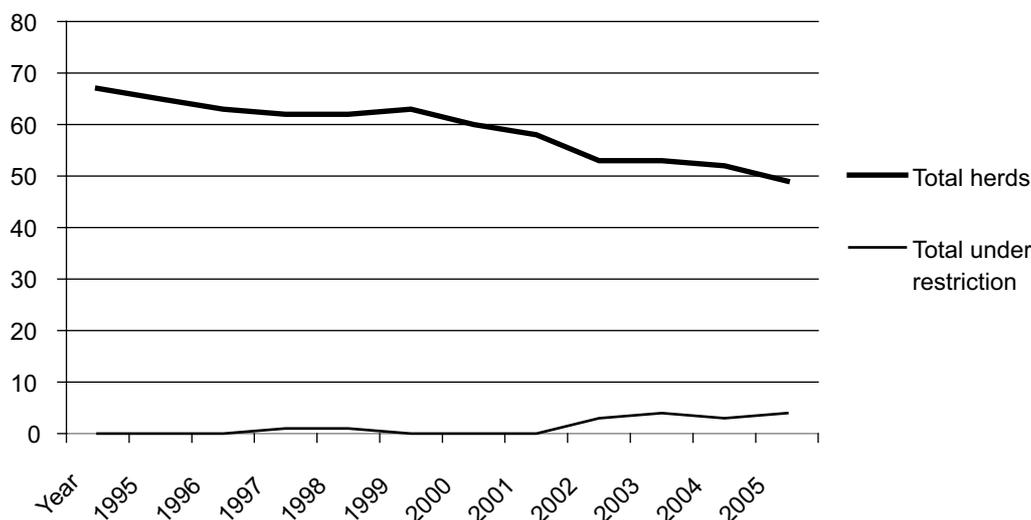
57. The third factor to note is that bovine TB had persisted at the same level for many years. This is consistent with the ISG's point that a persistent minority of 'problem herds' are at the heart of the bovine TB problem. Given the even distribution of badgers, this rather suggests that a factor within the management of the herd rather than within the local badger population is the cause of the problem.

58. The fourth and final factor to note is that the disease only increased sharply and consistently in the wake of foot and mouth disease. We lay the blame for this firmly at the feet of Defra and the NFU. Under pressure from the NFU, Defra allowed the restocking of slaughtered herds with untested livestock, triggering the most dramatic increase in bovine TB for years. This catastrophe was predicted by the Badger Trust and by the ISG, yet badgers have been blamed instead.

59. The following graph indicates the progress of bovine TB in a group of parishes centred on Coppenhall in Staffordshire. The other parishes are Acton Trussell and Bednall, Bradley, Castle Church and Dunston. We draw this example to the Committee's attention because Coppenhall's only infected herd is owned by Bill Madders, a member of Peter Jinman's Bovine TB Advisory Group.

60.

TB incidence in and around Coppenhall 1995-2006



61. Mr Madders' herd went down with bovine TB in 2006 and he told Farmers Guardian: "The local SVS view is that it is almost certainly badger contamination of the pasture last spring . . . The consistent view coming out of the State Veterinary Service is that until we do something about the disease in the wildlife it will get worse. It is the politicians that we're up against.[14]"

62. Yet for the last 10 years no herds in Mr Madders' parish have had bovine TB. In the surrounding parishes, only one herd had been affected by the disease for most of the period. Only since foot and mouth disease has that number risen to four cases, but the affected herds are scattered, with one in each of two parishes and two in Bradley. This scattered distribution is not easily explained if, as state vets and Mr Madders claim, a localised "infected badger sett" is to blame.

63. Again, note that the vast majority of herds in this area are not affected by bovine TB. And again note that the disease only increased significantly in the wake of foot and mouth disease.

64. In conclusion, the Badger Trust takes the view that a badger cull at any scale would be a grossly disproportionate response to the bovine TB problem. Instead, we believe that the Committee should urge the Government to instead adopt positive solutions that will be supported by everyone concerned and, in particular, by tax payers.

 POSITIVE SOLUTIONS
E. *Reforming Animal Health*

65. *Recommendation 1:* The Badger Trust recommends the establishment of an Epidemiology Research Unit that is fully independent of Animal Health. It will use lay staff under the supervision of independent scientists to gather useful epidemiological data to support the battle against bovine TB—and potentially against other diseases, too.

66. For 40 years, state vets have been responsible for advising on the best policy strategies for bovine TB control and for determining the course of scientific research in this field. State vets were behind the narrow terms of reference imposed on historic enquiries into bovine TB, from Zuckerman[15, 16] to Krebs[16], all of which focused attention on badgers rather than on bovine TB itself.

67. The ISG, to its credit, rejected this dogmatic approach in favour of a broader research base. As a result, the evidence now clearly shows that bovine TB is still very much maintained and spread by cattle[3]. It is transmitted rapidly to badgers who are the unwitting victims and consequential scapegoats.

68. Nevertheless, state vets and retired state vets continue to make public claims that they know best and that badger culling is essential. Yet despite their claims to be authoritative, state vets do not have any epidemiological evidence to support their argument. In fact, the opposite is true.

69. Animal Health (formerly the State Veterinary Service) is not currently able to effectively manage the bovine TB epidemic in Wales or in Great Britain because it lacks adequate data and its IT systems are, in the words of Animal Health itself, “archaic”[17].

70. In June 2007, the Badger Trust published a report demonstrating that state vets do not possess any evidence to explain the epidemiology of bovine TB or, as a result, to manage the problem of bovine TB. Their claims are, instead, based on supposition and anecdote[18]. This is not a satisfactory way to determine policy.

71. The report found that:

- (i) State vets do not collect sufficient evidence to explain the underlying epidemiology of bovine TB events. Furthermore, the limited data that is gathered is held on paper, not data processed and never statistically analysed.
- (ii) State vets rely on unreliable farmer evidence about where livestock have been held on farms with multiple land parcels. Consequently, state vets cannot say with any authority where a TB outbreak was acquired. This, in turn, means that it would be impossible for state vets to determine where badgers should be killed, in the event of the Government approving such a policy.
- (iii) Animal Health (formerly the State Veterinary Service) does not hold records on badgers, collected by state vets from farms, for post mortem examination.
- (iv) A wide range of failings in the state-run bovine TB testing programme was identified by the European Union in 2005. Many of these allow for undetected cattle-to-cattle, herd-to-herd transmission of TB.
- (v) State vets have not been kept up-to-date with new scientific research on bovine TB. The Introduction to the online bovine TB practise manual (VIPER) had not been updated for a decade.

72. The full report is available online at <http://www.badgertrust.org.uk/content/w-campaign.asp>.

73. Our analysis of subsequent data gathering by state vets (Appendix A) confirms that they still have no epidemiological evidence to support their demands for badger culling or to support the implementation of a badger culling strategy. Nor do they have data with which to comment on cattle management and other possible risk factors. They are effectively in the dark.

74. In summary:

- (vi) The SVS has never had a system for collecting and analysing epidemiological data on bovine TB.
- (vii) When TB99 (TB49’s successor) was implemented, the SVS consistently failed to obtain adequate scientific controls to complement the case studies. This greatly weakened the potential for sound scientific analysis.
- (viii) Disease control emergencies including classical swine fever and foot and mouth disease totally disrupted the collection of epidemiological data by state vets. Future outbreaks of disease will have the same effect.
- (ix) With the current Disease Report Form, Animal Health is failing to gather epidemiological evidence to inform the battle against bovine TB and the EU’s 2005 findings suggest that the DRF might be a futile exercise even in addressing the particular breakdown in hand.
- (x) State vets only gathered adequate data for the Case Control Study 2005 when a specific person was assigned to maintain internal pressure for its delivery.

75. When its report on Animal Health was published, the Badger Trust advised the then Secretary of State for the Environment, David Miliband, to treat state vets' advice with caution. The Badger Trust urges the Select Committee to take the same approach. Whilst we do not dispute state vets' good intentions, claims that are not supported by a robust evidence base should be rejected.

76. What is the alternative approach? Animal Health must play a central role if bovine TB is to be controlled. But resources are stretched and are likely to be stretched still further by inevitable, future outbreaks of animal diseases arising from intensive farming practices and large-scale animal movements. More efficient use must be made of resources.

77. The Badger Trust's report found that in 2005 and 2006 alone, state vets spent the equivalent of between 11 and 15 working years collecting paper-held data on bovine TB outbreaks. This is not an effective use of the time of skilled professionals, particularly given that the data contributes nothing to our epidemiological knowledge.

78. The archaic paper-based approach by Animal Health must be replaced with a new and independent Epidemiology Research Unit (ERU) with its own budget and team of lay researchers whose function is to gather epidemiological data on a digital system. The costs of investing in such a system could be balanced by reducing the number of state vets, who will no longer need to spend hours of time recording data on paper that is never to be analysed. Data gathering does not require the skills of a state vet, since it is essentially an administrative service.

79. Giving the ERU its own budget will protect it from the impacts of disease control emergencies faced by Animal Health. Decisions concerning what data are to be gathered, and the methodology used, should be made by an independent panel of scientists who can then update the data gathering protocol in the light of initial findings. The appointments to this panel should be independent of the chief vet and made, instead, by Defra's chief scientific adviser.

80. Whilst our focus is on bovine TB, it is also likely that the Epidemiology Research Unit will be able to gather data for use in combating other serious livestock diseases.

F. *Utilising independent scientific advice*

81. *Recommendation 2:* The Badger Trust believes that the Government should appoint an independent scientific panel to ensure that new TB policies are based on sound science and, crucially, that the benefits of the policies are properly monitored after their introduction.

82. In 61, above, the Badger Trust describes how state vets have maintained a focus on badgers in the search for a solution to bovine TB—and failed. In fact, it is now clear that cattle are the primary source of the problem and the supposed “gold standard” skin test is inadequate to the challenge of tackling bovine TB in a livestock economy that involves large, intensively managed herds, substantial numbers of animal movements over short and long distances and a testing regime that is not frequent enough.

83. At the root of state vets' failure to address bovine TB has been the misunderstanding that having a scientific background equates to having scientific expertise in the epidemiology of a disease. As illustrated in Recommendation 1, above, it is patently clear that Animal Health suffers from a lack of epidemiological knowledge, not a surfeit of it.

84. The Badger Trust believes that the time is right for a genuinely independent and scientific approach to formulating bovine TB policy.

85. State vets and the existing TB Action Group (TBAG) will, of course, still play a role in advising on the practical implementation of policy. But the formulation of policy must be science-based and removed from the bias and baggage associated with state vets and stakeholders.

86. The Badger Trust's preferred option is that advocated for a Science Advisory Board (SAB). The SAB was proposed by Defra's Science Advisory Council (SAC) in 2005 and accepted by former animal welfare Minister, Ben Bradshaw, in 2007[19]. Unfortunately, progress in establishing the SAB has been painfully slow, revealing a lack of enthusiasm in Defra where state vets wish to protect their positions as the main source of advice to ministers[20].

87. The Badger Trust respectfully draws the Committee's attention to the advice of Defra's SAC, which has provided a detailed proposal for the structure of the SAB. The SAC recommended that the SAB should have “the clear remit, breadth of expertise and coverage to enable it to have oversight of all available bTB science, both from within and external to Defra, bringing it all to bear in providing advice to the Department; such advice should include the identification of gaps in the evidence base . . . it was essential that bTB SAB had a chair who was independent”[21].

88. The SAC also warns of the dangers of confusing stakeholder input with independent scientific advice. As the SAC advised: “TBAG should not be seen, or used, as an alternative source of scientific advice to Ministers . . . the remit and role of TBAG needs to be clearly identified as distinct from the scientific advisory roles played by the [Chief Veterinary Officer] and the [Chief Scientific Advisor].”[21].

89. An additional role for the SAB—whatever form it takes—should therefore be to provide farmers, state vets and private vets with independent, clear advice on the science underlying bovine TB policy and the benefits that the policy is expected to bring. This will counter the speculative misinformation put about by farming organisations and help to minimise discontent and an unwillingness to co-operate with improved TB controls.

90. An independent scientific panel would be able to comment on the accuracy or otherwise of claims made about bovine TB control strategies, helping to ensure understanding of the issues within the farming community.

G. Improved slaughterhouse surveillance

91. *Recommendation 3:* The Badger Trust believes that the Government should establish an incentive system for people involved in the slaughter and inspection of cattle and deer, to maximise the reporting of suspicious lesions.

92. Before bovine TB can be controlled in cattle, it needs to be detected. The identification of bovine TB lesions at slaughter makes a modest contribution to the effective monitoring of the disease in cattle, even though only around 14% of infected animals have visible lesions[22]. Research also shows that deer, particularly high density farmed and park deer, show TB infection even more readily than do cattle, yet the Badger Trust notes that very few infected deer are ever reported, even though research has indicated a number of localities where the disease is clearly a problem in deer[23].

93. A study of the minutes of ISG’s meetings reveals consistent concerns about consistency and objectivity of slaughterhouse surveillance for bovine TB[24]. High variability in the consistency of slaughterhouse identification of bovine TB has also been found in the Republic of Ireland[25]. And in the United States, a bonus scheme has long been in operation for slaughterhouse inspectors, to improve standards of reporting. This has resulted in 38 of the 40 slaughterhouses which deal with 94% of the cattle in the US “meeting or exceeding targeted surveillance levels”. [26] (Michigan in the USA has a known wildlife reservoir for bovine TB in the form of white-tailed deer. These are fed illegally by hunters resulting in high densities that are susceptible to infection—not unlike deer parks and farmed deer in the UK. Virtually all other cases of bovine TB infection dealt with at federal level have been traced to cattle movements from Mexico).

94. The Badger Trust concludes that an incentive scheme for those involved in the slaughter and processing of cattle and deer should be tested, to see whether the consistency of slaughterhouse reporting improves.

H. Annual testing, gamma interferon and resource efficiency

95. *Recommendation 4:* The Badger Trust believes that the Government should: introduce annual bovine TB testing across England; apply whole herd slaughter for problem herds; urgently review the progress of gamma interferon testing and upgrade laboratory facilities accordingly; and, improve the use of resources by involving trained lay personnel rather than vets in bovine TB testing.

96. In 2001, the ISG noted that “annual testing of all herds will give a true measure of annual incidence whereas testing at two, three or four year intervals will not, because some of the infections detected could have been initiated in previous years”[27]. One of the consequences of this is that the apparent “increase” currently being recorded in bovine TB is in large part the product of increased testing. As more infected herds are found, the number of parishes subject to annual and biannual testing increases, leading to further discoveries of infection.

97. In July 2006, the ISG’s Chairman advised Defra officials that “a four-year testing regime was not appropriate. He and the Group believed that pre-movement testing was an important surveillance tool but that annual testing for the whole country was necessary. Resource for this should be found, some of which could be released by eliminating problem herds since 52% of tests were carried out on only 4% of herds”. Defra officials rejected this proposal on the grounds that: “the Department would not operationally be able to undertake uniform annual testing; a proportionate and measured response was required focussing on pre-movement testing with consideration of a new hotspot policy and greater use of the gamma interferon test. He said that annual testing for the National Herd would represent a disproportionate approach, and was not practicable to deliver with the veterinary resource available”[5].

98. It is not clear whether the ISG’s advice on annual testing was ever communicated to Ministers at Defra. However, the failure to implement an annual testing policy suggests that Ministers were unaware of this scientific advice. Given both scientific and farming support for annual testing, the Badger Trust believes that the Government should apply annual testing across England.

99. Also in 2001, the ISG observed that: “Given the increased incidence of cattle herds affected with TB, and the incomplete sensitivity of the tuberculin test, it is likely that increasing numbers of infected cattle are remaining undetected”. As more evidence emerged of the failure of the tuberculin test and as Defra dragged its feet on assessing the gamma interferon test, the ISG became increasingly frustrated: “We have consistently questioned the effectiveness of the conventional tuberculin test in situations of high disease incidence. Its value as a herd test is fully accepted, but as a test to identify individually infected animals it is far less dependable. The opportunities for disease transmission from infected animals at all stages of the disease process, and the difficulties of diagnosing some of these animals using the established skin test, have been demonstrated in laboratory and field studies on the pathogenesis of TB in cattle. We believe, therefore, that the case for developing improved techniques of diagnosis is overwhelming, and have repeatedly advised that far more emphasis be placed on this particular objective. It is for this reason that we have given continuing support to the development and field evaluation of the gamma interferon (IFN) test (although as yet not perfect) as offering the best prospects for more effective identification of TB-infected cattle. We have advised that complementary use of this test with the tuberculin test is the only realistic way of tackling the substantial reservoir of disease in cattle that appears to be present in some areas, and also to reduce radically the risk of transmission of disease to new areas of the country. Defra’s unwillingness to accept our advice on the design of a field trial of the IFN test which would be rigorous enough to yield the kind of data on its performance that are essential to provide an informed basis for its use in a range of control options, has been disappointing and extremely worrying”.

100. The value of the gamma interferon test should not be underestimated. Between 1 January and 31 July 2007, 18.3% of the cattle tested with gamma interferon in Wales were positive to the test. Inexplicably, the proportion in England was lower. In Wales, this resulted in the removal of more than 250 dangerous contacts that would otherwise have remained in the herd to infect other cattle. Yet as of 31 July 2007, Defra and the Welsh Assembly Government were still well short of the target of 50,000 cattle due to be subject to gamma interferon this year.

101. It is not clear why the implementation of gamma interferon is not taking place as rapidly as it should. The Badger Trust would welcome an assessment of the slow progress on this front by the Rural Development Sub-Committee. One problem is thought to be the lack of laboratory facilities to rapidly process the blood samples. The Badger Trust therefore believes that the Government must establish a suitable infrastructure for testing blood samples.

102. Finally, the Badger Trust believes that bovine TB will only be effectively controlled and reduced if the current infrastructure for dealing with it is subject to reform. The ISG has already suggested that removing the 4% of herds that currently consume more than 50% of the TB testing effort, thus releasing funds, could save resources.

103. In addition, we believe that lay personnel would be able to deliver the administrative functions of bovine TB control more cost-effectively than state vets. We have already cited the example of epidemiological evidence gathering. Other key functions that could be dealt with by administrative, lay personnel rather than qualified vets include:

- (i) Organising the removal of test-positive cattle from farms—something which farmers believe is taking place too slowly;
- (ii) Organising the valuation of cattle and compensation, to ensure fairness for both farmers and tax payers;
- (iii) Undertaking detailed checks of farm records and the British Cattle Movement Service, to ensure compliance with the relevant legislation (this task currently falls to Trading Standards Officers, but often in the wake of reports of possible non-compliance by state vets).

I. The politics of the issue

104. Following the publication of the ISG’s final report, farming groups have argued that more intensive culling and/or culling over very large areas (ideally with some “hard” boundary) would make badger culling feasible. The Badger Trust notes that the ISG rules out these options[12] for scientific, practical and economic reasons. We also note that farming groups have failed to make an economic case for such a strategy; they have not made clear how it could be delivered in practice with humaneness and rigour. Nor have they made clear how the huge range of practical problems, such as limited access to land, could be addressed. We would be surprised if farming lobbyists have provided convincing answers to these questions when they met members of the Select Committee on their recent visit to Devon.

105. The Badger Trust rejects claims by farming groups (and, it is alleged, by Lord Rooker) “that the ISG has gone outside its remit”[28] with the cost-benefit analysis in its report. A detailed examination of the ISG’s minutes confirms that effective cost-benefit analysis (CBA) has long been part of the ISG’s remit. Ministers were kept fully informed of progress on this front through the ISG’s regular reports. The ISG’s work on cost-benefit analysis was detailed at some length in 2000, in the ISG’s second report to Ministers.[29]

106. The Badger Trust notes tensions between Defra and the ISG over the issue of cost-benefit analysis. Although Defra was well aware of the ISG's work on this front, it nevertheless pursued its own CBA (Research Project SE3117) and 'the project was to proceed regardless of any scientific review procedure and [Professor McInerney, the ISG economist] considered this an abuse of the system. The [ISG] Chairman agreed'. In the event it made little difference, since Defra's own partial CBA failed show any economic justification for badger culling.

107. Farming groups have complained that the ISG undertook a "partial" cost-benefit analysis, in focusing only on badger culling and not on the costs of cattle controls.

108. The Badger Trust points out that badgers are a public good. The public response to consultations on badger culling has shown that they are highly valued by the public. It was essential that the ISG considered the cost-benefits of badger culling. In contrast, cattle are a private good. The cost-benefit analysis for protecting this private asset falls to the owners, the farmers, although inevitably Government has an interest in this cost benefit analysis since bovine TB is a zoonosis and since taxpayers are currently subsidising the private economic interests of farmers through compensation for TB losses.

109. Farming groups have suggested that the ISG should have considered "the economic, social and ecological cost if cattle farming were to be made unviable in some areas of the country".[30] This a classic example of muddled thinking from the unions, in which a range of private and public goods are lumped together and treated as one. It suggests that the farming unions continue to believe that the cost of addressing bovine TB is an issue for the public purse rather than for the industry.

110. In fact, the viability of the livestock industry is more significantly influenced by the shift away from production subsidies in a global marketplace, where economies of scale will inevitably squeeze smaller producers out.

111. The Badger Trust believes that the Select Committee would greatly help matters if it were to make it clear where it feels the responsibility for controlling bovine TB lies. Significant global forces are changing the structure of the beef and dairy industry and the Government must avoid falling into the trap of confusing these global shifts with the impacts of a disease that affects a relatively small proportion of herds as a direct result of farmer behaviour.

112. Given that tax payers are currently subsidising the livestock industry with compensation for a disease which could be 70% eliminated if farmers agreed to participate in effective testing regimes, deciding who should pay is an issue of critical importance.

113. We make the following observations: 70% of the bovine TB problem is attributed to cattle-cattle transmission; cattle infect badgers, a protected species, with bovine TB in the first place; public health is protected by the disposal of milk from reactors, by pasteurisation and by cooking meat properly. Therefore, the cattle-based benefits of bovine TB control are effectively a "private good" and the economic responsibility of farmers, who are the primary beneficiaries. But since taxpayers are delivering compensation, the Government needs to take responsibility for taxpayers by compelling farmers to comply with a stricter testing regime.

114. It has been suggested by some farming lobbyists that placing the economic responsibility of bovine TB control on farmers would destroy the industry. The Badger Trust observes that livestock auctioneers claimed that pre-movement testing would have a similar effect and this was clearly wrong. Nevertheless, if the costs of delivering effective standards of farm animal health and welfare are beyond some sectors of the industry, that is not the fault of badgers and badgers should not be scapegoated for those shortcomings.

115. The Badger Trust is also concerned at the limitations of the ISG's cost-benefit analysis, but for different reasons. We note that farming lobbyists are obsessed only with the cost-benefits of badger culling. No consideration is given to the cost-benefits of other possible measures that would minimise the risk of bovine TB transmission from cattle to badgers, and back again.

116. The ISG's final report notes that more than 90% of bovine TB-infected cattle present with pathology that "implies that such infections are acquired as a consequence of close contact with other animals (cattle or wildlife)". The ISG also concludes that the pathology of bovine TB in badgers also "suggests that most infections are acquired via the respiratory route".[12]

117. In the field, there is little opportunity for close contact between cattle and badgers: badgers rarely approach within four metres of cattle. In farm buildings, however, CCTV footage has now shown that badgers come into very close contact with cattle when foraging in cattle feed.

118. The Badger Trust finds it extraordinary that no-one in either the farming community or in Government has yet produced a cost-benefit analysis of keeping badgers out of farm buildings. We suggest that before the Government even considers badger culling, it should fund a case control study of preventing badger access to farm buildings, feed stores, cattle sheds and troughs, to see what effects are achieved in minimising bovine TB transmission between cattle and badgers.

119. This would, in effect, be the Plan B that the former Agriculture Select Committee called for way back in 2001.[31] For minimal investment—by the taxpayer, if the Government deems it worthwhile—it is possible that the majority of the small amount of negative feedback from badgers could be eliminated in this way, to the satisfaction of farmers and taxpayers alike.

October 2007

APPENDIX A

TB DATA COLLECTION BY STATE VETS

1. In the wake of their analysis of TB49 data gathering[8], the VLA researchers made two key recommendations:

2. (i) If epidemiological data collection becomes the primary goal of the breakdown investigation there will be the need for continual monitoring of the completed forms to ensure high quality data is obtained.

3. (ii) The two goals of widespread data collection and prompt management of the incident may turn out to be competing. To avoid this it is recommended that the TB99 [the anticipated successor to TB49] adopt a modular approach in which the incident management section of the form is separated from the epidemiological data collection section.

4. TB99 was indeed created in a modular fashion. Its fate, however, illustrates why state vets are so poorly informed. TB99 was employed from 1999 to January 2005. The Independent Scientific Group (ISG) attempted to ensure that TB99 provided adequate information for epidemiological analysis. But this proved difficult, as the draft document moved back and forth between the ISG and state vets and as it was tested in partnership with farmers.

5. By February 1999, the final draft of TB99 had already moved away from focusing on epidemiological groups and back to individual animals”,[32] thus weakening its epidemiological purpose. An outbreak of Classical Swine Fever soon resulted in a serious backlog of TB99 data, whilst FMD resulted in no TB99 forms being completed at all and the entire data collection exercise became “fragile”.

6. By March 2002, it became clear that Part 2 of the TB99 form—the part focusing on husbandry—was not being completed properly by veterinary officers. By July 2002, the ISG was expressing concern at Defra’s failure to ensure the collection of adequate numbers of “controls”. The original aim had been to apply TB99 to every outbreak farm within the badger culling trial areas and also to apply TB99 to three control farms (with no breakdown) for each breakdown farm. But the failure to gather enough control data began to make the whole data gathering exercise “pointless”.[32]

7. An analysis of the minutes of the ISG suggests that Defra and the State Veterinary Service regarded the protection of human and animal health as a greater priority than research, missing the point that the former could not be achieved without evidence from the latter.

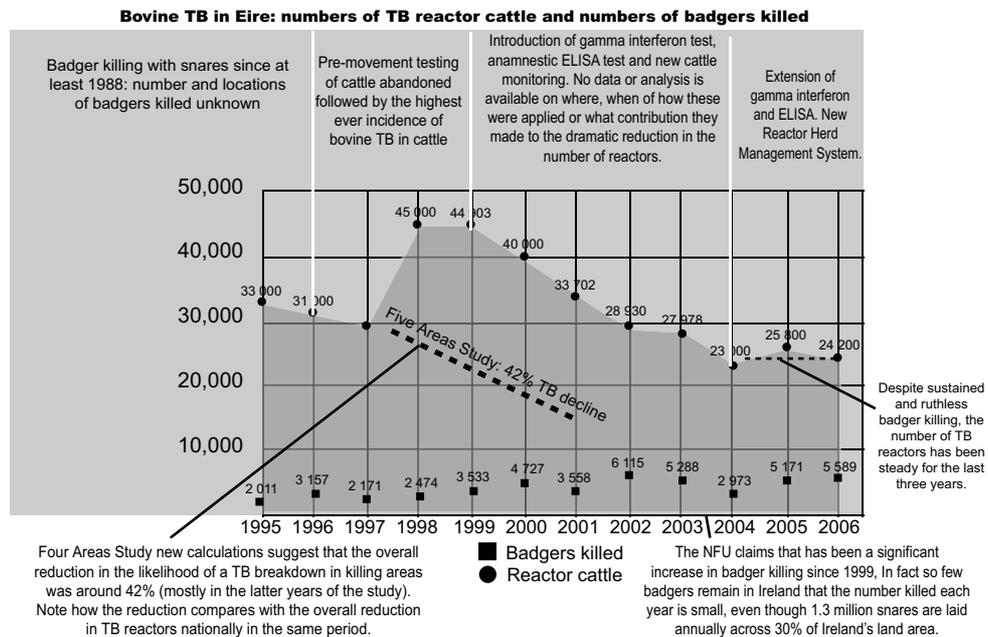
8. ADAS was contracted to complete TB99s, at a cost of £280 each. But the whole operation became farcical, as state vets who had failed to complete the forms in the first place then complained that they had to spend time checking the accuracy of forms completed by ADAS. Meanwhile, farmers—who were ultimately to benefit from the research that taxpayers were funding—complained that completing the form with a vet was too “onerous”. An independent audit of the data left the statistician who was supposed to analyse it feeling “depressed”.[32]

9. In July 2004, the SVS said that statutory duties meant that it would not be able to complete adequate TB99 forms for that year. In January 2005, TB99 was abandoned in favour of a new Disease Report Form, which lacks an epidemiological objective. The epidemiological elements of TB99 were instead replaced with a simplified Case Control Study (CCS2005) which was to be a single year study.[33] Only in 2005, using this CCS, did state vets gather adequate cases and controls to inform epidemiological analysis. This was due to “a simpler form to complete, well-organised project management and the trouble-shooting abilities of [the SVS representative on the study group]”.

10. At the time of writing, Animal Health continues to use the Disease Report Form to gather evidence during a TB breakdown. Contrary to the recommendations of the VLA, however, it does not use a modular approach to provide epidemiological evidence. Instead, the focus is supposedly on controlling the specific incident.

11. Yet the methodology is inadequate even for this purpose. In 2005, EU inspectors reported that the data is “not evaluated at local or central level in order to ensure that the decision concerning [the] source of infection/disease spread was correctly done and consequently appropriate measures would be taken”,[34] as described in Recommendation (i) above.

Badger Culling in Ireland



APPENDIX C

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Monday 15 October 2007

Members present:

Mr David Drew
Mr James Gray

Mrs Madeleine Moon
David Taylor

In the absence of the Chairman, Mr David Drew took the Chair

Memorandum submitted by Professor Douglas Young and Professor Glyn Hewinson

Douglas Young is chair of VPAG (Vaccine Programme Advisory Group), a group of academic, industrial and government scientists who provide advice to Defra on the development of vaccines for control of bovine tuberculosis (bTB). Glyn Hewinson is a member of VPAG and leads the bTB research group at the Veterinary Laboratories Agency (VLA). VLA is a major contractor for Defra-funded research on bTB vaccines.

Tuberculosis—in people, cows and badgers—involves a fine balance between a virulent bacterium and the host immune system. In human TB, the outcome of this encounter is generally in favour of the host (only 10% of infected people actually show signs of disease) and tilting this further towards the host by vaccination has been a major research objective since the time of Robert Koch. Progress towards a vaccine for human TB was made in the early years of the 20th century with development of the BCG vaccine (a live attenuated TB bacterium originally isolated from a cow), but BCG has proved inadequate for global TB control. There has been a major renewal of human TB vaccine research over the last decade, fuelled by new opportunities arising from genome science. The Global Plan to Stop TB¹ envisages that an improved vaccine for human TB will be available for use by 2015. It is estimated that a budget of the order of \$3 billion over the next 10 years is required to reach this goal.

The bacteria responsible for bTB are very closely related to the major human pathogen,² and fundamental features of the immune response to TB are shared across all mammalian species. It may therefore be possible to exploit advances in human TB vaccine science to develop tools for control of bTB. Vaccination could be applied for bTB control in wildlife or directly in cattle. Research in this area is underpinned by strong collaborative projects across the UK, Republic of Ireland and New Zealand.

VACCINATION OF BADGERS

“Vaccination more effective than culling?”

Although the BCG vaccine has had limited impact on human TB, decades of experimental research have shown it to be very effective in guinea pigs. Would BCG vaccination provide a tool to control bTB in badgers, at least to the extent that it would reduce transmission to cattle? In 1997 the Krebs Report on Bovine Tuberculosis in Cattle and Badgers viewed this as a potential back-up plan, though it was considered that the partial effect of vaccination—perhaps reducing disease by 70 or 80%—would always be lower than the 100% reduction achieved by culling. The potential role of badger vaccination has to be re-evaluated in light of two findings in the recent ISG Report. Firstly, the Report presents definitive evidence that badgers do make a significant contribution to the incidence of bTB in cattle. Secondly, the ISG identified a detrimental “perturbation” effect associated with culling; vaccination may provide an alternative strategy that avoids this.

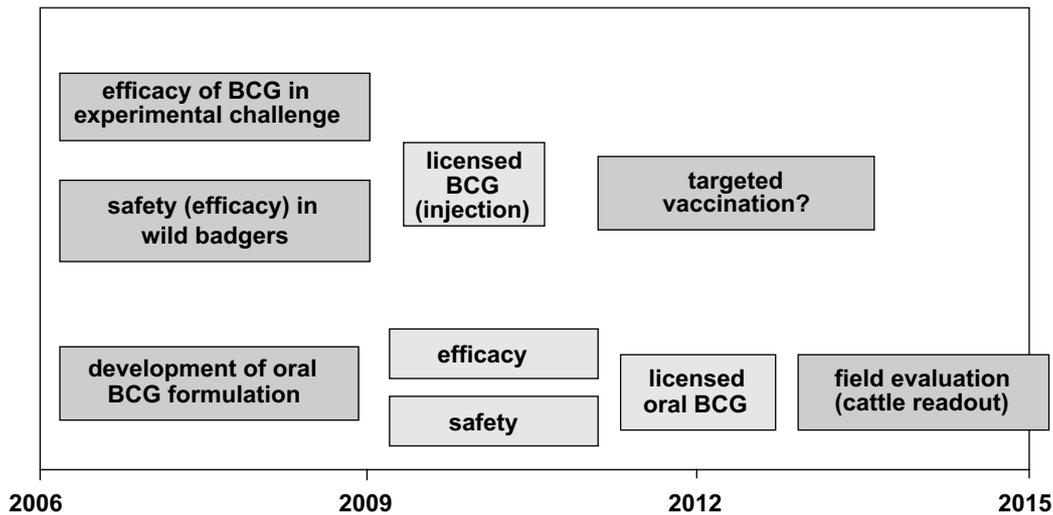
To obtain a licence to use BCG in badgers it is necessary to show that the vaccine protects animals against bTB in a controlled experimental setting, and that it is safe for use in a natural setting. Experiments to test this are underway, including a controlled trial of BCG vaccination in over 300 badgers in the Cirencester area. If successful, it is expected that BCG would be available for use in 2010. The current vaccine has to be delivered by injection and therefore requires trapping of badgers. This may have application in targeted trials—as a ring-vaccination strategy in combination with trap-based culling, for example—but large scale use will require a vaccine that can be delivered in the form of an oral bait. Several oral formulations of BCG are currently under development, and it is anticipated that an oral vaccine could be available from 2012.

The impact of badger vaccination has to be assessed in terms of reduced transmission to cattle. Monitoring the effect of badger vaccination in defined geographic regions may provide a mechanism to achieve this. Figure 1 illustrates the VPAG timeline for badger vaccine development.

¹ <http://www.stoptb.org/globalplan/>

² The DNA sequence of Mycobacterium tuberculosis, the human pathogen, is 99.95% identical to that of the Mycobacterium bovis, the pathogen responsible for TB in cows and badgers. This is roughly the same level of genetic identity shared between two human individuals.

Figure 1. VPAG Timeline for Badger Vaccines



VACCINATION OF CATTLE

BCG vaccination has been assessed in cattle. The results are similar to trials of BCG against human TB, with widely varying outcome in different countries, though with some of the most encouraging results being seen in the UK. Can we develop improved cattle vaccination protocols analogous to those now going forward in human trials? A range of new vaccines have been tested in cattle exposed to experimental infection. Again the results parallel findings in human TB, with the best protection obtained using BCG combined with a second booster vaccine. BCG itself was found to be particularly effective when administered as a neonatal vaccine to calves under 6 weeks of age.

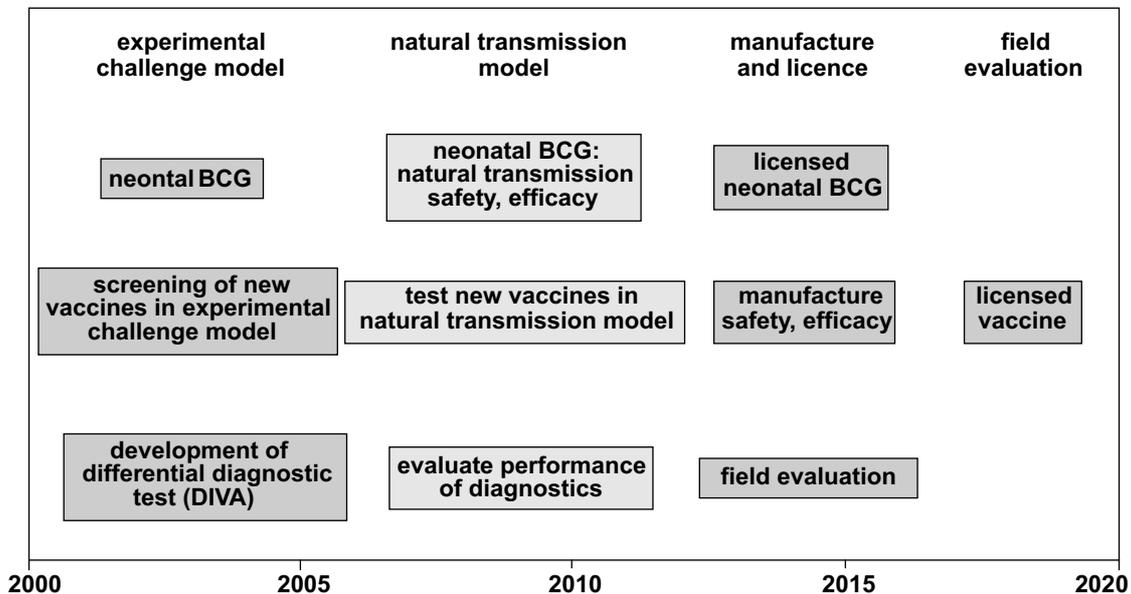
In addition to its variable efficacy, BCG has the drawback that vaccination primes animals to respond to the tuberculin skin test used for diagnosis, and its use is therefore incompatible with the standard test-and-slaughter policy for disease control and contravenes EU legislation. It was necessary to develop diagnostic tests that distinguish bTB infection from BCG vaccination. This has been achieved by taking advantage of genetic differences specific to the vaccine strain. Differential diagnostic tests are also important in the context of wildlife vaccination programmes using oral baits that may inadvertently be taken up by cattle.

“How good is good enough?”

In the experimental challenge model used to compare new vaccines, all of the animals receive a high dose of infection which leads to rapid progression of disease. To get a better idea of how a vaccine might perform in the field, a natural transmission model has been set up. This involves housing vaccinated and control animals together with diseased cows; monitoring infection using blood tests, with a final disease assessment port-mortem. At the current stage of the VPAG timeline (see Figure 2), a comparative trial of the best new candidate with BCG has been initiated in the natural transmission model; first results will be available by the end of 2008.

To assess new vaccines we have to consider the performance characteristics required in a vaccination programme. Would vaccination be introduced as a national policy, or in defined local circumstances? To prevent infection, or just to reduce transmission? What are the national and international trade implications? Who would pay for vaccination? As part of the vaccine development programme, Defra has initiated work to address these questions. The availability of vaccines does not necessarily equate to use; the balance of cost and benefits will remain a question for policy makers.

Figure 2. VPAG Timeline for Cattle Vaccines



“Cattle vaccines for global development?”

The expense of test-and-slaughter policies precludes general use in developing countries, many of which have no programme for control of bovine TB. Cost-benefit assessments of cattle vaccination are therefore significantly different from the UK. In a parallel project supported by the Wellcome Trust, cattle vaccines are being tested in a natural transmission model in Addis Ababa, with results fed into an economic model of the impact of bovine TB in Ethiopia.

SUMMARY

Research is underway to develop and test vaccines to control bovine TB in badgers and cattle. It is anticipated that the earliest date an injectable vaccine for badgers could be licensed is 2010, followed by neonatal BCG for cattle in 2012. Oral BCG for badgers is expected to be available from 2012, and a cattle vaccine that improves on BCG from 2015. The timeframe for moving from the availability of a vaccine to its use in practice will depend on assessment of its performance in the broader context of control policy. Outside of its potential role in the UK, an effective cattle vaccine could have important health and economic benefits in developing countries.

October 2007

Witnesses: **Professor Douglas Young**, Imperial College, London, Chair of the TB Vaccine Programme Advisory Group and **Professor Glyn Hewinson**, Head of the TB Research Group, Veterinary Laboratories Agency, Weybridge, gave evidence.

Q248 Mr Drew: Welcome everyone. We will make a quick start. Can I say from the outset there may be a vote so we will have to disappear. The idea is to try and do a fairly succinct investigation into the progress with vaccine work in bovine TB. We will aim to finish somewhere about 5.45pm because Members have other things to attend to. We are a quorum. I am standing in for Michael Jack and I am very pleased to do so. We have before us Professor Douglas Young and Professor Glyn Hewinson, both of whom are working in this area. I think it would be helpful, gentlemen, if you work on this word succinctly and just say very quickly what work you are undertaking in terms of your own institution to give us a feel for where we are coming at it from. Perhaps, Professor Young, could you make a quick start.

Professor Young: I am a professor of medical microbiology at Imperial College. I also work at the National Institute of Medical Research at Mill Hill. My main research interests are in tuberculosis in general so most of my actual research is on human tuberculosis. My involvement on bovine TB is that I chair VPAG, which is a Vaccine Programme Advisory Group. I am also the project leader on a bovine TB project out in Ethiopia. Mainly I come from the human TB side.

Q249 Mr Drew: Professor Hewinson?

Professor Hewinson: I am the leader of the TB Research Group at the Veterinary Laboratory Agency and also a visiting professor at Imperial College, London. My group is engaged in a number

15 October 2007 Professor Douglas Young and Professor Glyn Hewinson

of areas of research activity to do with bovine tuberculosis. The areas that are of interest to this Committee are the development of vaccines for cattle and for badgers and diagnostic tests which can be used in conjunction with those vaccines in cattle.

Q250 Mr Drew: Thank you both very much. If I could declare a quick note of interest. I have been to the badger vaccine trial site, which is in my constituency. We will come on to look at the badgers. I want to start with the possible search for a vaccine with cattle. I return to the evidence you gave to us, Professor Young, three years ago where you were arguing in terms of a vaccination strategy and we were very much working at the edge of science. Is that still the case? We are quoted religiously this idea that we are ten years away from a vaccine, that is a mantra that is repeated. How do we get the ten years down to a much more acceptable and hopeful figure because farmers are looking for this? I think the one thing this Select Committee, both in its current guise but previously as the Agriculture Select Committee, has always argued is there needs to be a plan B. We have never said what that plan B is but I suspect that most of us would work on the proposition that is at least using the vaccination strategy as a central point to that. How do we get the figure down from ten years?

Professor Young: We have worked very hard over the last few years to get away from always ten years into the future by trying to sketch out a plan where there are certain bits of research activity that have to go on and these take a certain amount of time but that we can map our way through that. I have tried to do that in this briefing document to try and give you some idea of where we are in those activities. It is true for both the human vaccines as well as the cattle vaccines and there has been a lot of progress in the last few years in the human vaccine really defining endpoints of that and really defining realistic times when we can get through to having a vaccine. I think we have sketched out a scenario for the bovine TB in the same way that we can see an endpoint. It does take ten years so there is a certain biology of this disease, it does take a certain amount of time just to go through the number of experiments that you have to go through. You cannot necessarily magic away the ten years but you can say, "Well, we are now three years further ahead than we were last time I spoke to you".

Q251 Mr Drew: So is that seven years now?

Professor Young: I cannot remember exactly. When did we come?

Q252 Mr Drew: Even I can work out ten minus three equals seven.

Professor Young: I think I said 15 last time. I think we do come out with these time points when it is realistic from the research point of view when we can complete those experiments. There is scientific uncertainty underlying those but these are experiments so they either work or they do not work. If they work in our favour then we have time points when we would have vaccinations.

Q253 Mr Drew: Can I interject there to put this into some context. The period of time, is that because in a sense the efficacy of what you are carrying out has to be given that period of time? You may have a successful vaccine, you may feel that this is the way forward, but until you have absolutely nailed it down in terms of all the possible outcomes, some which may be good, some which may be adverse, you would not dream of putting this out on the marketplace.

Professor Young: The way that we can tell whether we have a successful vaccine is whether an animal gets protected from the disease and the disease takes a length of time to develop so we have to vaccinate animals, put them in a situation where they may or may not develop disease and then monitor whether they get disease or not. The turnaround for that is about 18 months just for that simple experiment.

Q254 Mr Drew: In terms of what we already know, because we will come on to the BCG as being the preferred route, although of course there are other vaccines that we would like to hear about also being tested, to what extent is it possible to derive real scientific understanding from our work with human beings in this area in as much that in the developed world it is wrong to say we have cracked TB but we have largely reduced it to a level where it is no longer seen to be a developed country problem. What about the issue of learning from the human analogy, is that feasible or difficult?

Professor Young: One lesson that we can learn is that globally we think that BCG in humans is most effective if we give it at a very early age. We think the activity of BCG in humans does not work so well when you go back to your environment so we use it as a neonatal vaccine. As part of the research programme on bovine TB over the last three years it has been shown that it works better as a neonatal vaccine in cattle as well. That would be one simple bit we have learnt. The other analogy is while we are trying to make a better human vaccine what we have settled on is that we need to stick to BCG and add something on top of that. That is the way the human vaccine development is going on and that looks like the best way forward for the cattle vaccine.

Q255 Mr Drew: Can I be clear that there is an infusion, if you like, from the understanding of the human being as a test case for possibly working on either cattle or badgers in the area of bovine TB?

Professor Young: There is good overlap between the two. I think we do learn from them.

Q256 Mr Drew: Professor Hewinson?

Professor Hewinson: I would pick up on that in terms of many of the vaccines that are looking promising for humans which are going into clinical trials—Phase 1, Phase 2 and Phase 3 clinical trials—have or are being tested in cattle as well, so the most promising vaccines which are coming out of the human field are being tested in cattle. We should have a fairly good idea if those vaccines are looking

promising for cattle within the next year. Of course you have to wait another ten years for Phase 3 trials in humans so you will get a better idea.

Mr Drew: I think we will come on to time a bit later.

Q257 Mr Gray: I am a bit thick perhaps, I did not quite follow what Professor Young was saying. At the beginning of our session, could you clarify, do you believe that it is or is not going to be possible to produce a vaccine for cattle and, if so, roughly speaking, how long will it be before that arrives? The last time you gave evidence to us, two or three years ago, you were extremely cynical about it and you were really saying it was probably very unlikely. Do I detect that you are slightly more optimistic now? Is there or is there not going to be a vaccine for cattle?

Professor Young: I cannot give you a yes or no answer. I would say on balance I would be optimistic and the date that we give here is for an improved cattle vaccine by 2015 which would be eight years. It is not a matter of just saying, "You take these steps and it will happen", there is a scientific uncertainty.

Q258 Mr Gray: Of course. In terms of saying to the world and to the farmers what they should expect, you are saying as the experts in the field you would hope that (a) it is possible to have a vaccine and (b) we would hope to have that by 2015. That is my understanding, is that correct?

Professor Young: Yes. That is what I would like to try and bring forward, to try and get those hard dates.

Professor Hewinson: I would say that there have been advances over the last three years that give us more hope in terms of developing a vaccine suitable for cattle.

Q259 Mr Drew: What sort of advances, Professor Hewinson?

Professor Hewinson: I think the two things which have happened in the last three years are firstly the development of diagnostic tests which differentiate between vaccinated and infected animals.

Q260 Mr Drew: That is now clear-cut, you can determine that this animal is infected as against this animal has been vaccinated?

Professor Hewinson: You can do that. Real progress has been made from sequencing the genomes of BCG which is the lead candidate vaccine and *M. bovis*. What is less clear is whether you can differentiate between animals that are vaccinated and are constantly exposed to infection compared with animals which are infected. Those trials are ongoing at the moment in a natural transmission experiment so we should know the answer to that within the year. The other advance, I should say, is that it has been shown that it is possible to improve BCG in cattle so there are vaccines which are looking more effective in experimental situations than BCG in cattle. That gives us hope.

Professor Young: I think another way that is useful to bring in at this stage is when we say, "Do you have a vaccine or do you not have a vaccine?" It is not going to be a tool which gives 100%, this disease just

disappears so it is going to reduce the amount of disease the animal gets, it will increase their resistance and then becomes more of a policy issue how much reduction of disease makes it really worthwhile as a control tool. I think that is quite important.

Q261 Mr Drew: Given the response to James Gray earlier, you are on the more optimistic side of the continuum. To what extent is it possible to predict that you could in all but name eradicate bovine TB in the same way, as I said that we have eradicated TB amongst the developed world or is there always going to be some legacy bovine TB which we have to learn to live with? It is one of those questions, "Are you beating your wife" type of thing, but give us a hunch.

Professor Young: I would imagine it should be easier to eliminate bovine TB than it is to eliminate human TB. I would caution that although you think you have eliminated human TB I would be cautious about that. I do not think it is going to be a vaccine on its own, it will be a vaccine as part of a combination of policies. The fact that you can take infected animals and you can kill them is a hugely powerful tool compared with humans.

Q262 Mr Drew: Sticking with cattle for one last question, one of the things I have never quite understood is that when you get a breakdown, unless it is a huge breakdown, there are always cattle which do not succumb to bovine TB. They often get slaughtered, or have been, because we take the decision that it is easier to take the whole herd out or a significant number. I realise that from policy terms that has begun to become less of a way forward. To what extent have you thought about using the natural resistance of some cattle as the way to which you might be able to develop a vaccine. In other words, you have got the BCG, you take an animal which has been in direct contact with bovine TB which clearly has not over time succumbed to that TB, so it must have some level of resistance, is this understood in any way or is this something which has been studied or something which is a missed opportunity?

Professor Young: It is quite difficult to study, you are looking at the same animals—

Q263 Mr Drew: I understand you are dealing with an animal, there may be ageing and it may subsequently develop TB.

Professor Young: There is a certain degree of random effects, it depends how many bacteria that particular animal happened to breathe in. Where it is clearest to my mind that there is a difference is when you look at very different breeds of cattle. When we look at this project that we are doing in Ethiopia, we are looking at cattle that come from very different lineages, very different genetic backgrounds, and they do seem to have a difference and we are very interested in that scientifically.

Q264 Mr Drew: You say you are very interested in that, are you researching that? Are you looking at how the vaccine may work with different species of cattle, may work with cattle which has been directly impacted on by a breakdown? Is this something which is going on?

Professor Young: This is something which is going on in this case out in Ethiopia because we can see it, it is a much more extreme situation there. With cattle we can use modern and genetic tools to map it. We know the sequence of the cattle genome and we are trying to then say, “Can we associate those differences in susceptibility to differences in the genetics of those animals”.

Q265 Mr Drew: Does this fit with what you said earlier, this is the idea of a vaccine almost plus natural resistance as being the best way that we will fight bovine TB? I am not saying is it 70:30 or 60:40, I am just saying if you add the two things together—

Professor Young: That particular tool of trying to breed your cattle to take out enhanced resistance in the national herd is not something I am an expert on.

Q266 Mr Drew: That is what we are doing with sheep after all, with scrapie. We are trying to breed the national flock which is scrapie resistant and breed the scrapie out.

Professor Young: If you can do that without losing other traits about milk yield and other factors about the cattle, that might be interesting. From my point of view, I would see it more as a fundamental understanding of the disease.

Professor Hewinson: Even in the Ethiopian situation which we have been looking at, the animals which seem to be more resistant, only produce one or two litres of milk whereas even a sick Holstein Friesian produces 20 litres of milk, so even though they are more resistant in terms of production it would be very dangerous.

Q267 Mr Drew: Let me be clear on this. Are you saying there is almost an economic argument about the degree to which we might look at a different type of animal, obviously an animal that is resistant to TB but would also be boosted by a vaccination against TB, that might have adverse consequences on its ability to produce as much milk?

Professor Hewinson: With any breeding programme, if you are just breeding purely for resistance, you stand the chance of breeding out other production phenotypes. You have to take that into account, I think.

Q268 Mr Drew: If we can move on to vaccines for badgers and, as I say, I have seen the badger vaccine trial site. I am eternally grateful for being given permission to go and have a word with the lady who is overseeing it there. Again, the issue is, having got I think two years’ results—tell me if I am wrong but I think we have got something like two years of results—to what extent can we now pressurise for earlier answers to some of the key questions about, “Does the BCG vaccine have any benefit in terms of the resistance it could give badgers against

succumbing to bovine TB?” You might also want to add on what links you have got internationally, although we are going to come on to that and I know this is not just a national experiment. I will not go too far as we are going to look at that in a bit more detail later. Professor Young?

Professor Young: The primary purpose of the badger vaccine experiment was to get information about the safety of BCG. If we are going to use BCG in badgers we need to license it and to license it we would need to have clear data that it was not going to make the disease worse in the wild badger population. Also, the licensing authority would look at efficacy data in an experimental setting. The primary read-out from the badger vaccine trial is safety and we have very promising results on that. Since we are doing a trial, we can try and get some indication of efficacy at the same time. It is too early in the trial, we did the first vaccination in—

Professor Hewinson: —2006.

Professor Young: We were supposed to be trapping and revaccinating at the present time but we have been put on hold, as you know, because foot and mouth closed down the batch where we would have picked up some data in revaccinating. We will not get it this year.

Q269 Mr Drew: You are saying at the moment that you are not able to vaccinate.

Professor Young: Because of foot and mouth we have not been able to trap this season and that puts us back. June is our next time.

Q270 Mr Drew: I think we will be writing to the powers that be to say, “Are there special exemptions which could be allowed” because one of the problems with bovine TB is that we lost out in terms of the original ISG trials because we were affected by foot and mouth then and I think we are not happy that we are going to see slippage again. Everyone will say it is a good thing, so I think we have made advances.

Professor Young: That is my understanding, that the trapping has been cancelled this season.

Professor Hewinson: Also that was in sensitivity to the landowners wishes who did not want workers going on to their land while the foot and mouth was an issue.

Mr Drew: I understand that. I understand we have to have special clearance. Some would argue that foot and mouth is sadly affecting rather a small area, bovine TB affects rather a large number even though economically both are, sadly, very dangerous to the livestock.

Mr Gray: They are different areas, Chairman.

Q271 Mr Drew: As I say, completely different areas. We are going to look at the international work in a minute but the parallels with what was learned from Ireland, is that something which has been integral to the work that the badger vaccine trial site has been doing, presumably drawn on that experience, although there are those who criticise the way the science was conducted?

Professor Hewinson: Do you mean in terms of what Ireland have been doing on vaccinations?

Q272 Mr Drew: Yes, the work they have been doing on vaccinations but also, of course, in the sense that came on the back of their attempting to look at the culling strategy, so I will be interested to know to what extent the science is helpful rather than being very different.

Professor Hewinson: In terms of the vaccine development, we have been working very closely with the Republic of Ireland in terms of badger vaccine work, indeed we have had workers working in their laboratories and their workers have come over to ours. Essentially we have developed the immunology for badgers which the Irish are using to look at the vaccination of badgers with the BCG. In Ireland they are allowed to experimentally infect badgers with *Mycobacterium bovis*, they have now developed those infection models which allows you to look at how well BCG protects badgers. They have shown that both injectable BCG and oral BCG, given in a formulation that has been developed by New Zealand—and I am sure we will come back to talk about that later—gives good protection against experimental challenge. Where we differ is that we are pursuing an injectable vaccine as the first phase of our vaccine strategy because that is the quickest to license and will be the quickest way to get vaccination out into the field. Ireland are looking at oral vaccination, they are planning an oral vaccine trial now, but that formulation is not manufactured by any manufacturer so it is not made to good laboratory practice. Even if the product looks promising they will have to do another trial based on the safety type approach that we have been doing with injectable vaccines.

Q273 Mr Drew: Can I ask one final question. Given the importance of the work at the badger vaccine trial site, because we all know that a cattle vaccine has got some downsides, not the least of which is whether we can retain our TB-free status as a nation within the EU, why has this not been replicated in other parts of the country? It would be useful perhaps to do some comparisons. Here we are, again, trying to pursue the whole of a hunch in one part of the country which may have quirky badgers, let alone quirky results from that experimentation, is that not a weakness of this? If someone was to come and say, “Here are two more areas” you would bite their hands off, would you not?

Professor Young: We would go and do it. There was a lot of uncertainty about going forward with a badger vaccine in the first place, so if you go back a few years we had the Krebs Report which saw badger vaccination as a second-best strategy. If you cull the badgers that gets rid of them 100%, if you vaccinate them you may just reduce the amount of disease. For a long time it was not our mainstream policy. Since the ISG proved that badgers were contributing to the bovine TB problem and showed that culling has downsides then I think we have ramped up the badger vaccine programme significantly. That we should be ramping it up more,

which is what you are suggesting, would be something we can take on board. I think within a year, we have said in the document by 2010, we would hope we would have a licensed vaccine but I think a year from the badger vaccine trial we will begin to get a feeling for are we moving in a positive direction. If we are moving in a positive direction we would be strongly counselling to expand that type of study.

Q274 Mr Drew: That information will be shared with appropriate parties? One of the things which impressed me about the badger vaccine trial was the degree to which the scientists were willing and able to talk to the farmers—partly to keep them on board—about whether they thought what they were doing was of value.

Professor Young: I think we do chime with the public, people like the idea of vaccinating.

Q275 Mrs Moon: I would just like to clarify a few things for myself. You have talked about the trapping having stopped which means whatever results you are going to have are going to be delayed another year because of foot and mouth. You have also said, yes, it would be helpful to have other areas where you are also carrying out trials so you could have comparison studies. Can I clarify who would need to agree to those other areas, and I assume we would also need funding for those areas?

Professor Young: A fairly substantial amount of funding to run and you would then have a local team. I do not know whether you would run out of the number of people who were very close to CSL on these, how many experts there are available who could run those trials in the same way.

Q276 Mrs Moon: Do we have the experts to run those trials or not? Would it be realistic to say let us have, even if not two, one other trial area so we can compare the results? Do we have the experts even if we have the money?

Professor Hewinson: What I was going to say is that this trial is not really to do with working out how efficacious BCG is, it is about licensing BCG that you could then take into the field. There are two philosophies: do you do a lot of field trials that may or may not give you statistically significant data that you might have to wait a long time to get both in terms of how effective the vaccine is in badgers and then how effective it is at stopping TB breakdowns in cattle or do you focus your efforts in licensing the vaccine by showing that it has a protective effect in the experimental situation and that it is safe in the environment and then just rolling that vaccine out and monitoring how effectively it works. There are two different philosophies.

Q277 Mrs Moon: Is BCG the only vaccine that has been trialled? Has anything else been trialled with badgers or just the BCG?

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Professor Young: Just BCG.

Professor Hewinson: Just BCG.

Q278 Mrs Moon: We have just got BCG. Can I clarify in terms of the licensing route, which is the one you are following, is it sufficient in a licensing regime to have one trial? Is that going to be satisfactory? In the longer term are you going to come up against a lobby which says, "Hang on, the science is not good enough because it has only been focused around one trial"?

Professor Hewinson: I think those are two different things. You have got the licensing issue where if you show that the vaccine is safe experimentally and safe in the environment in the natural situation, and you show that the vaccine can do what it says on the bottle experimentally, then you can get a licence to use that vaccine. How you then use it and how you apply it and how effective it is is the second question.

Q279 Mrs Moon: My question was, is one trial enough for those two routes?

Professor Hewinson: I do not think this trial is going to give you strong enough statistics in order to tell you how effective the vaccine is. It will be good enough for licensing but it will not allow you to tell how effective a vaccine will be used in the field. To do that you would either need to do further trials or you would need to roll that vaccine out, it may be in specific areas, and see how effective it is, so monitor it as you use it.

Q280 Mr Drew: Is that not the whole point of what I thought we were trying to do with the badger vaccine trial, to look at the licensing arrangements, to see if it makes a difference? Obviously we are testing the badgers because there is no point in trying the vaccine on them unless we are able to look at the numbers with TB and the numbers not with TB. To me it would seem pretty obvious that you have to roll that forward. There is an argument about whether you do it intensively in the same area or whether you do a comparison and slightly different things in the comparison to tweak it to see if this makes any difference. Again, it is this thing about time, we always seem to be looking for another reason why we can have another experiment which can then give us even more definitive evidence rather than say, "Look, this is costing the taxpayer, let alone farmers, millions of pounds every year. It is causing grief beyond any normal expectation." If plan B is the vaccine route, and we have not yet managed to define that there is a successful let alone an acceptable plan A, why do we not go for it?

Professor Hewinson: I think that is what I was saying. Once you have licensed it you can go for it and then monitor how well it works so that would give you an extra tool that you can use. You will have to think how best to use it and monitor how effective that is or otherwise you spend those resources doing a large field trial which may give you some evidence in 5 to 10 years time.

Professor Young: What we need to measure is what happens in cattle.

Q281 Mr Drew: Yes. We are doing that, are we not?

Professor Young: We are increasing our knowledge about what is happening in badgers but at the end of the day, whatever happens in badgers, is that sufficient to stop the badgers spreading the disease to cattle.

Q282 Mr Drew: We are measuring both, we are measuring badgers and cattle.

Professor Young: I do not think we have got big enough. In the badger vaccine trial I do not think we have a big enough study that we would expect to see a big impact on cattle. We need to roll it out to a larger study area.

Q283 Mr Drew: That again begs the question why are we not doing a bigger study. We will come on to that.

Professor Hewinson: Because it was set up as a safety trial, not an efficacy trial.

Mr Drew: I am aware of that. These are nice terms but people are holding a lot of hope out that this is going to provide some good definitive evidence for the first time.

Q284 Mrs Moon: Perhaps I am just a simple townie, I do not understand why we are running out a trial which says, "Yes, it is safe in the countryside if we do not know that it works". That seems like nonsense to me. Given the amount of money that is pouring into this, I do not understand why we are not looking at the efficacy at the same time. I would hope you are going to have some indication of the efficacy. It might not be the full report that you might go on to do but I would hope that what we do not get is, "Yes, it is wonderfully safe but we do not know if it works". I would hope we are at least going to get a result which says, "Yes, it is safe for the field and it looks as if we have got at least an 80% but we need to do more research that would confirm that". Is that what we are going to get to or are going to get to, "We do not know at all if it works"?

Professor Hewinson: What you will get to is you will have experimental data which tells you that the BCG does protect badgers and that is in an experimental situation. BCG in most animals does reduce TB quite considerably when they are challenged with the organism and when they are given an experimental infection. That is what you need to license it. There is evidence that it works, how well it works in the field is a different question. You may get some indication in this trial of how well that works, I am not convinced that you will get statistically robust data to tell you how well it works, but one of the things which would come out is, "Yes, we need to increase the size of the trial to get statistically robust data".

Q285 Mrs Moon: Should we be increasing the size of the trial now? Would that make the trial have greater validity? Is that the route that we should, as a Committee, be pressing on to Defra? Is that a route which would mean that at the end of however many

years, towards 2010/2015, whatever, we will have something that is a lot more concrete? Would that be more useful?

Professor Young: That was this question of having more trial sites which I responded to favourably because I would like it to have more statistical relevance but the other way of thinking is what I really want to know is what will happen in cattle, which is the next stage of it. Maybe we should try, as quickly as possible, to get our indications that it is working in badgers, get a licence and then try and roll that out into a study, and use monitoring I would say where we would look at cattle breakdown in some larger geographical area that we would roll out this vaccine into.

Q286 Mrs Moon: How are you going to look at the success of the vaccine in the field and its impact on wildlife? How will you know it is working? What about other wildlife such as deer, are they going to be excluded? Are you going to be monitoring them at the same time, what is happening there? A big sigh!

Professor Young: The current vaccine we are using is where you trap the badgers and inject it and there it is unlikely other wildlife are not going to pick up that vaccine. One of the issues that the licensing people want to know is do the badgers shed the BCG after we have injected them and we do not think they do but we are looking at that. Where we would like to move to, because it is a more useable tool, would be one you would give orally so it would make some oral formulation of BCG that you could throw about the countryside in the form of bait.

Q287 Mr Drew: Which is what the Irish are using?

Professor Young: No, the Irish have got an oral one but they trap them or they snare them and then deliver it orally but they do not have a bait formulation. When we get to the stage that we have an oral vaccine that we could distribute that way then we need to think very carefully about what other animals would pick that up, including cattle, and it becomes a bigger issue that way.

Q288 Mrs Moon: If you get into the dog walker population you would be in real trouble.

Professor Young: Yes, you would need to be very careful about those things.

Q289 Mrs Moon: Yes.

Professor Hewinson: In terms of your question about how you might monitor how effective it is, in the badger population you can look at the immune response to see if they have become infected or, as the New Zealanders have done in their vaccine trials and how the Irish are planning to look at it in their trial issue, kill all the animals at the end, post-mortem them and see how many had the disease and how many did not have the disease. That is probably your best way of knowing.

Q290 Mr Drew: Sorry, can you say that again?

Professor Hewinson: The way that New Zealand has looked at the effect of the vaccine in their possum field trial and the way the Irish are planning to look

at the effect of BCG in their badger vaccine trial is to vaccinate over a number of years and then to kill their whole population that they have vaccinated and not vaccinated in the whole area and looked to see how much TB is in their control animals compared with how much TB is in their vaccinated animals.

Q291 Mrs Moon: Is that what you are planning to do?

Professor Hewinson: Not at the moment, no. At the moment we are following the immune responses of the animals to see how many immune convert and how many do not so that gives you a good idea of how much protection there is, or not. The committee will look at this trial at the end to see whether the indications from the immunology are enough or whether you do need to do that.

Q292 Mrs Moon: If I can just ask one final question to get it clear in my head. At the moment you are going for the trapping and injection route.

Professor Hewinson: That is the fastest route to get another tool into the field to try and control TB.

Q293 Mrs Moon: I appreciate that. In the longer term, if what you put together in terms of the BCG formula that you are using, if we are thinking about rolling it out across the country then it is going to have to be in the bait form, I assume.

Professor Hewinson: Yes.

Q294 Mrs Moon: At the same time you are working on how you can introduce bait or are you concentrating on the vaccine and if that proves to work you will then look at the baiting at a later date or are you going to try baiting at the same time within this trial?

Professor Hewinson: We are working in parallel so, yes, we are working with the people in New Zealand and Ireland on the oral vaccine formulations. We are trying to work out what would be the best baits for badgers, what would be the best way they would take up that vaccine.

Q295 Mrs Moon: What is the food source that they will go for most.

Professor Hewinson: Yes, exactly.

Q296 Mr Drew: Maize!

Professor Hewinson: There are a number of things. They like ground chicken meat. We are looking at that in parallel, but if the injectable vaccine does not look as if it is having an effect then oral vaccination obviously would not have an effect.

Mrs Moon: Given the lack of experts that you have talked about, I cannot see that we have enough to run a vaccine trial across the country.

Mr Drew: I will take that as a comment.

Q297 David Taylor: A moment or two ago you were referring to work being done in Ireland and New Zealand. I think there is also work being done in the United States inevitably and in Ethiopia. How are

you liaising with the research that is happening in those countries to feed it into your own priorities and work programme?

Professor Hewinson: In both the cattle and badger vaccine programmes, those collaborators are written into the grant proposals so they are working very closely with us. In fact, some of their work is funded by Defra in terms of badger oral vaccine development, in terms of testing cattle vaccines and in terms of support for collaboration between countries in their research programmes.

Q298 David Taylor: How does this influence the priorities and timetable work of the Vaccines Advisory Group?

Professor Young: That is quite often an agenda item and there will be a report on these international links.

Q299 David Taylor: The research that has been done in those four countries I have mentioned, are there other countries who are doing anything to any substantial extent and where are they getting the resources from to undertake that research?

Professor Hewinson: I would say that the main players in terms of the vaccine development for bovine tuberculosis are New Zealand. They have focused on cattle and wildlife vaccines, possum vaccines, and from their work this oral formulation is looking very promising. Initially it was developed for possums but it is now being tested in Ireland and it is also being tested in the United States in deer. All those trials look promising in terms of the oral vaccination formulation they have produced. It seems to be as good, or almost as good, as injectable vaccines. Most of the funding from New Zealand is funded by the Animal Health Board in New Zealand, although Defra funds some of the cattle vaccine work and is also funding some of the oral vaccine development work in Ireland. In the Republic of Ireland most of the funding comes from the Republic of Ireland and in the US the USDA funds the US work.

Q300 David Taylor: The crucial question is has any nation at any time and in any place ever demonstrated evidence that TB in cattle can be controlled by vaccination?

Professor Hewinson: There have been a number of studies, in fact using BCG in cattle, over the years. The story was very much the same as the human story: in some trials it worked very well and in some trials it did not work at all. It is not clear, because the methodology used is so different, why it sometimes succeeds and why sometimes it does not succeed. The most promising trials that were done were actually done in the United Kingdom. There is some evidence that BCG vaccination reduced infection by about 50% in cattle. The reason BCG was never used for control was that it sensitises cattle to the tuberculin skin test and, therefore, you could not carry out a test and slaughter strategy along with BCG vaccination. That was the major overriding thrust of why BCG was not used in the 1950s.

Q301 David Taylor: Are you both convinced that progress is being made? The Chairman, at the start of his remarks, talked about a ten-year time frame. It still seems to be a bit like a mirage: we complete three years work and we still seem to be a decade away from something specific, hopeful, tangible and effective.

Professor Hewinson: I would hope that the timetable we showed you and the discussion we have just had means that an injectable BCG vaccine could be licensed by 2010, then how you apply that and use it needs to be looked at. A licensed product could be available within three years.

Q302 Mr Drew: That is for badgers.

Professor Hewinson: That is for badgers. I should also say that the legislature requirements have gone up almost exponentially in the last ten years, so instead of a dossier so big you need a table full of dossiers to achieve the same thing, some of which is scientific and technical—we are working at that edge of knowledge—but some of it is also legislative and bureaucratic. We are spending millions of pounds showing that BCG is safe in badgers and it is being used in more people than any other vaccine.

Q303 David Taylor: Do you agree with that robust confidence?

Professor Young: Yes. On the research side I think we can produce these things and we have given dates when we can produce them. Whether the impact of them will be sufficient to fulfil the policy needs still needs consideration.

Q304 Mrs Moon: That 2010 date you gave us, does that become 2011 if you do not do your work this summer? Will it not move it on?

Professor Young: No. What will happen is we need a certain amount of time to elapse anyway so we would have been looking at the vaccine trial badgers now and we would be looking at them again next year. We will just miss a little window in between. I do not think we will lose a year on that.

Q305 Mr Drew: In the sense that the international comparisons are very interesting, because we are all looking at similar but not necessarily the same studies, are any of those studies internationally looking at the impact of a vaccination strategy on cattle alongside a vaccination strategy on a particular wildlife reservoir? This has always been one of the issues: do you go for the cattle vaccine, do you go for the wildlife vaccine or do you go for both on the basis that the herd immunity could affect, one hopes optimistically, not just the herd you are vaccinating but the other species, which is part of this problem. Is there a relationship between wildlife and cattle or is it always cattle or wildlife?

Professor Young: New Zealand is all wildlife now; Ireland are still interested in cattle; in Africa it would be all cattle. We are the only broad-minded community that is doing both.

Q306 Mr Drew: In the great days of international co-operation, that is a bit of a dilemma, is it not? What is not to say that whatever effectiveness a vaccine has in one species it would be much more effective if you were able to vaccinate across species. This goes back to the issue of the deer. Here we are solving a problem with the badger population by vaccinating them but lo and behold the cattle impact does not go down nearly as much as we had hoped because there is another wildlife reservoir out there. Why is this not being looked at in a more comprehensive way?

Professor Young: It goes back to the business of sensitising the animals. The vaccination was going to sensitise the cattle in a way that compromised the diagnostic test used in the test and slaughter so it is illegal in European law at the present time to use a vaccine in cattle because it compromises the diagnostics. You had to have that advance.

Q307 Mr Drew: Let us be optimistic and we do get that differentiation between those that have been vaccinated as against those who have the disease. We persuade the EU that we know what we are doing because we have now separated those animals out and have an effective vaccine, but again it would be helpful if we all had, at the same time, a wildlife vaccine. It is an interesting thing because we are not doing it together. The badger vaccine experiment is purely on the badger and the impact may be measurable in terms of the cattle, but the cattle, of course, I cannot judge because I have not seen the cattle vaccination work. I do not know if that is having an impact on the badger. Is this not something which is a bit of a hole in the scientific hypothesis?

Professor Young: I would concede that, yes; I think you are right. In order to control this disease you do have to work on both of those populations.

Q308 Mr Drew: It would be pretty sensible to have some element of working on them together.

Professor Young: Standing back, scientifically I agree with you, but in practical terms that is the way it worked out. It is difficult to combine the two programmes. We keep them co-ordinated if we are talking about both but it would be the morning badgers and the afternoon cattle. It is very difficult to put together a practical programme where you are running them both together at the present time. The next stage of looking at the badger vaccine will be to have a cattle read out. That is where we would like to go but it does have an increase in the magnitude of the trial you are looking at.

Q309 Mr Gray: Defra are spending currently £10.5 million on research all together. How is that divided up between the two?

Professor Hewinson: I think it probably splits into about £3.5 million a year on cattle vaccine and £2.5 million on badger vaccine.

Q310 Mr Gray: Is that the right split?

Professor Hewinson: Because with badgers our only option is BCG, there is not that development work required to produce vaccines that are better than BCG. The cattle work is more scientifically demanding and requires more of that.

Q311 Mr Gray: £3.5 million and £2.5 million makes a total of £6 million. I thought Defra were spending £10.5 million so what happened to the rest of it?

Professor Hewinson: I do not know.

Mr Gray: The learned clerk has given me a piece of paper telling me Defra is currently spending £10.5 million.

Mr Drew: That is over time. I do not know if you want to give us a note on this. There is some question about what money has gone in and how it has gone in.

Q312 Mr Gray: It would be helpful to have a breakdown as to who is spending what.

Professor Young: The ball park numbers I have are: £5.5 million per year at the present time on vaccine and £18 million from 1998 to March 2008. That is the sort of numbers.

Q313 Mr Gray: What about CEDFAS, is that going to be beneficial to this research, Combating Endemic Diseases of Farmed Animals for Sustainability?

Professor Hewinson: There were two projects that have been funded by the BBSRC in that area: one is dealing with one of the questions raised, is there any evidence of genetic resistance in cattle, and the other project that I know was funded was looking at strain differences, so the different strains of *M. bovis* that are in the country and is there any evidence that these strains are evolving to escape a skin test. It does not directly feed into this work. The other point I should make is the really expensive aspect of this work is in the containment facilities that are required for the cattle work and the badger work and indeed the field work. A lot of the money is going on animals rather than scientific endeavour.

Q314 Mr Gray: Are we spending enough on it altogether overall? Is it the sort of thing where if you pile in tons of money we will actually find a solution or not really?

Professor Young: One of the ways that if we use more money we would reduce the risk, as I said right at the start, is the biological determinism in this time frame, how quickly we can get it out. I do not think necessarily money can shorten that dramatically. Where money could be put in would be if we would do more things in parallel and that could certainly be done. We have a fairly slender track where we are doing just one thing at a time. If that works, that is fine. If we had more money we would reduce the risk by trying more options simultaneously.

Q315 Mr Gray: I saw the secretary note that down so you will not be getting more money now!

Professor Hewinson: There are two bottlenecks and the first is in testing the vaccines. You have investigated this a bit, both in the field and

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experimentally. There are not that many facilities which allow that testing so that really is a bottleneck. The second thing is in the fundamental research and understanding of what constitutes protection. I think that area could also benefit from more funding.

Q316 Mr Gray: To wrap-up our afternoon discussions, I mentioned in passing we had the Minister sitting in the audience, and no doubt officials with him. What else should be the government be doing in this whole area looking into vaccinating cattle?

Professor Hewinson: In terms of trying to move things faster?

Q317 Mr Gray: In general what would you like the government to be doing that they are not currently doing?

Professor Young: The area I would highlight, which they are beginning to do, is that for the many years we have sat here it has been down to the researchers to come up with this vaccine which is going to magically make everything disappear; there will be some magic bullet which will come out from a laboratory and all the problems will be solved. I do not think that is realistic. We can produce a range of tools, injectable BCG or different vaccines for potentially different efficacy, and I think the government has to think very carefully how you would use these as policy options. What do you think a vaccine would do? How would you use it if it had 80% protection? Would you use a vaccine that would have to prevent all the animals ever getting any disease whatsoever or would it be sufficient for a vaccine which controlled outbreaks or controlled transmission of the disease? I think to get a little more policy formulation from the top as to how we would use the vaccine would be enormously helpful from the development point of view because then we would have clearer end points as to whether our vaccine is working or not working. That is something which has only happened in the last year or so where Defra have begun to take that on board and it is a very positive move.

Q318 Mr Drew: I take that point up. In the paper, which presumably came to us from Defra or you wrote it on behalf of Defra, basically that sentence you said at the end of how good is good enough: "The availability of vaccines does not necessarily equate to use. The balance of costs and benefits will remain a question of policy makers", when Edward Jenner came up with the vaccine for smallpox, nobody knew whether it was actually going to eradicate smallpox. The policymakers thought we have no alternative here. We have people dying by the thousand, let us stick it in them. Cattle pox is what we gave them and lo and behold we cured smallpox in all but name. Why do we not get on with it? Why do we not say this is our next best alternative to watching us spending millions of pounds slaughtering lots of animals which is getting us no further forward. Let us get on with it. Let us do a big-scale experiment. Let us tell the New Zealanders and

the Irish and the Americans what we are doing and hope they get behind us and maybe do similar things. It has got to be better than what we are doing at the moment.

Professor Young: It did take us 200 years to follow up on Jenner.

Q319 Mr Drew: We have gone somewhere in the last 200 years.

Professor Young: I do not think you just jump in the deep end immediately. What we would like to do is get a little bit of evidence that we are moving in the right direction and the badger vaccine experiment is moving us towards that. I would like to see a little more evidence before I would jump into your big experiment.

Q320 Mrs Moon: You talked about needing a magic bullet and we accept there is not going to be a magic bullet. I think we have moved on. Although I take the Chairman's point about Edward Jenner, it did work and it was wonderful. Realistically, given that things mutate, even BCG in humans is facing a challenge of new strains, do you have in your head a level of efficacy that actually would mean that you think this is a level that makes it something we have to do? Is 50% good enough? Is 60% good enough? Do you have that central figure of efficacy that you would be looking for as a guideline?

Professor Young: We need to have some sort of policy. How we are going to use it you would need to think about before you set that number, what you mean by 50%. Does that mean 50% of the animals would have no bacteria in them whatsoever or all of the animals would have 50%?

Q321 Mrs Moon: 50% less episodes of cattle needing to be destroyed. I was thinking about the long term. Realistically we are looking at a huge economic cost to the farming industry. That is what this is all about. This is not about "Poor badgers, they have TB, we must sort that out"; this is about a huge impact on our farming industry. If we can cut TB slaughter of cattle by 50%, would that be good enough?

Professor Young: That is a policy question and I think that is what they are working with. Policy people with Defra are trying to work that through. It has been silly the way we have had it before that the researchers were supposed to come up with that view. There has to be a pragmatic cost-effective policy view that you then feed back into your experimental design and set the end point.

Q322 Mrs Moon: We also have to know how efficient you think your product is going to be. If we do not know that it is effective in at least 60 or 70% of badgers, we cannot then extrapolate into what the potential impact is going to be on cattle. Are you going to be able to come up with some sort of awareness or figure that will let us have some idea of how effective you think it will be in terms of the overall population of badgers, bearing in mind that if we are going for a baiting trial we are going to miss some?

Professor Young: We will come up with some number. From the under experimental conditions, we will come up with a hard number from there and it will be something like 70%.

Professor Hewinson: There are a couple of things I feel need doing apart from the science and one is this clear product profile: what do we need, what are we aiming for. I think you are absolutely right there. The second thing is a manufacturer and supplier, someone who is going to hold the licence. Those are absolutely critical.

Q323 Mr Drew: We will not say where; it is a sore point.

Professor Hewinson: The other thing I would say in terms of trying to define how effective the vaccines are, as we talked about earlier, hopefully some of this field trial will give us some indication of how effective the vaccine will be in badgers. We have a natural transmission experiment in cattle where we have infected animals and we introduce vaccinated and non-vaccinated cattle into that herd of reactor animals to get some idea of how effective it is.

Q324 Mr Drew: Are we actually vaccinating cattle that have been infected by bovine TB who are suffering at the moment?

Professor Hewinson: No. We are vaccinating animals and introducing them into contact with infected animals.

Q325 Mr Drew: There is no point in vaccinating an animal who already has bovine TB?

Professor Hewinson: No.

Q326 Mr Drew: Is that because of choice or because you are not allowed to because under the current arrangements an animal that has bovine TB should be removed?

Professor Hewinson: There is very little evidence I have seen of therapeutic vaccines. This is one of the big goals for human vaccine work.

Q327 Mr Drew: Do we vaccinate humans who have TB?

Professor Hewinson: No, we treat them with antibiotics.

Q328 Mr Drew: But we then would subsequently vaccinate them?

Professor Young: No. There is no evidence that BCG does anything if you have TB.

Q329 Mr Drew: That is why we need to work on other vaccines.

Professor Young: That is why we give them very early before you see TB.

Q330 Mr Drew: I thought we still gave them some BCG. We will take that as the final word. That was an interesting conclusion. What you have said cannot be unsaid. We may take subsequent evidence from you. This is an interesting topic and certainly a topic that has to give us some answers some time because we cannot go on the way we have been going. I thank you for your evidence. It is good the Minister has sat all the way through this session as we will be asking questions of him subsequently. It has been very helpful and I thank you for being so succinct because we have kept to just over our hour and we have some interesting results. Presumably if we wanted to gain more front-end understanding of how this is working, in the same way as I saw the presentation on the badger vaccine trial, you would be very happy to give us something. Could you do the two side by side? I found the one that took us through how the trials were actually working very helpful because just listening to you talking about it is not the same as having someone do a presentation.

Professor Hewinson: It might be very useful to come and visit us at VLA to see the scope of what is really required in doing these things. That puts it in context in a way that really allows you to see in a much better way the scope of what is involved.

Q331 Mr Drew: I take that as an invitation that we would be pretty daft not to follow up on.

Professor Young: You can come and sit in our territory where we would be very much more relaxed.

Q332 Mr Drew: Knowing how time is limited, could we put the things together and see if we could do a couple of presentations on cattle, badgers, even if we would like to cross-mesh them sometime in the future?

Professor Hewinson: Yes. Can I say one other thing on the time lines? We have put those together and we feel those are realistic. Those are best case scenarios if everything goes well but best laid plans of mice and men, and foot and mouth—

Mr Drew: We are not bringing mice into this! Cattle and badgers are enough for us.

Wednesday 24 October 2007

Members present:

Mr Michael Jack, in the Chair

Mr Geoffrey Cox
Mr David Drew
Mr James Gray
Patrick Hall
Lynne Jones

Dan Rogerson
Sir Peter Soulsby
David Taylor
Mr Roger Williams

Witnesses: **Professor John Bourne CBE**, former Chairman, **Professor Christl Donnelly**, former Deputy Chairman, and **Professor Rosie Woodroffe**, former member, Independent Scientific Group on Cattle TB, gave evidence.

Q333 Chairman: Good afternoon, may I welcome those who have come to what was going to be a session initially to give the Independent Scientific Group, who have done a lot of work on badgers, the opportunity to respond to observations passed on what was in their final report by the National Farmers' Union. However, the late entry on the scene of a report by the Government's Chief Scientist, Sir David King, has added yet another twist to the inquiry which the committee is making into this subject. We are going to be welcoming Sir David in a few moments to have an opportunity of questioning him about his findings. First, we want to welcome the former members of the Independent Scientific Group: Professor John Bourne, the former Chairman, Professor Christl Donnelly, the former Deputy Chairman, and Professor Rosie Woodroffe. We are grateful to you for coming. For the avoidance of doubt, we gather there is going to be a series of votes so we will concentrate in the few moments we have available on enabling the group to respond to the comments by the National Farmers' Union. Professor John Bourne and his colleagues are going to stay on afterwards so that they may give us the benefit of their observations on what Sir David King has to say. No doubt if he wants to comment in reverse, we could go on for quite a long time on this, but we will try to bring matters ultimately to a conclusion. We are also delighted to see that one of our most regular attenders, Lord Rooker, is with us once again. If he sits there long enough, he will find himself as a witness before the inquiry. We are delighted to see you, Jeff. I start, John, with a simple question: what are your reactions to what the National Farmers' Union said, particularly in the context of their observations about culling and your final report?

Professor Bourne: They were obviously very confused about what they expected to be in the final report. Their implication was that we had rewritten the report at the last moment, which suggested that they had been given information which they expected to be consistent with our report—this is me surmising now—but it was not consistent with the report. There was clearly misunderstanding. The claim that we rewrote the report at the last minute under political pressure is absolutely absurd, utterly absurd. I have provided you with documentation throughout the period from September 2005 to May

2007 when we reported our findings to Ministers; we had meetings with Ministers and these were reported in minutes. I do have other papers to support those findings, which as Chairman of the ISG I was told I could not give to you.

Q334 Chairman: Who told you that?

Professor Bourne: Civil servants. As non-chairman of the ISG, I will give them to you. I will give them to your Clerk. I leave it to your discretion as to what you do with them. It shows very clearly that we are absolutely and utterly consistent in reporting the findings of the trial to Ministers throughout the period. We are absolutely consistent with what we reported in the final report. Apart from that, we had close deliberations throughout our work with Defra officials. It has been on a monthly, weekly, sometimes daily basis. There was no misunderstanding at all at the official level what the findings were, which way the ball was bouncing. Indeed, we published papers throughout, as you know. All these papers were considered by our Defra colleagues, many of whom were co-authors. Every paper as it was submitted to a journal was copied to the Minister. All I can say is that the NFU comments are totally and utterly unfounded. There were clear misunderstandings, but there was a total consistency in our reporting to Ministers throughout the period after which trial data entered into the public domain, when they passed it to Ministers, which was for an autumn report I believe that I do not think saw the light of day. From that time on, there was open discussion within Defra with respect to the trial data and publications.

Q335 Chairman: Since the publication of your report, have you had any discussion on a personal basis with the National Farmers' Union or its representatives, or is this the first time you have had the opportunity in public to say what you have said?

Professor Bourne: No. I was able to meet representatives of the NFU at the open meetings that we held in London and in Cardiff.

Q336 Chairman: Were they able to mount any kind of objective alternative view to the conclusions that you put forward on those occasions, or did they say

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they were going to do that? Was it just a subjective assessment, a point of disagreement, in terms of the conclusions that you had reached?

Professor Bourne: I do not think there was any objective assessment on their part that I am aware of, other than the material that they presented to your committee, and also material that they presented to a similar committee in the Welsh Assembly.

Q337 Chairman: Let us move on to Lord Rooker. How do you react to his comments about the report when it came out?

Professor Bourne: I did not know they were his comments. I saw them in the *Farmers' Guardian* but we all know that comments can be misrepresented very easily. I did write to Lord Rooker, as I was asked to comment by the press, asking if he could confirm what he had said. I am yet to get a reply.

Q338 Chairman: Since the publication of the report, have you actually met with any Defra Ministers? The Secretary of State told us yesterday when he came before us that he was going to meet with you. Have you met with anybody in between times?

Professor Bourne: I met Lord Rooker this morning. The last meeting I had with Ministers was with the Secretary of State and Mr Bradshaw. I have given you details of that. I think that was in February.

Q339 Chairman: That is a long time ago. Do you feel you had a fair hearing with Lord Rooker today in getting across your message? I would not expect that he gave you an authoritative and opinionated response to your report, but did he accept what you had to say?

Professor Bourne: He gave me a cup of tea!

Q340 Chairman: Did you just sit there with a cup of tea?

Professor Bourne: Pretty well. I listened to his anecdotes about his career movements and visits to farms at home and in Ireland and about official reports in Ireland. The one thing I did glean was the importance that he will attach to your findings.

Q341 Chairman: I am delighted about that but clearly the rigorous exchange between yourself and current Ministers is yet to take place.

Professor Bourne: I did have a letter or an email from the Secretary of State on Monday morning saying, among other things: "Thank you. David King's report will be released later today. You will receive a copy and it would be nice to meet up some time."

Q342 Mr Gray: Can I pick up one point first of all? You mentioned a moment ago that civil servants in Defra had instructed you that you were not to release particular documents to this committee. Could you tell us, please, which documents they were; secondly, which civil servants gave you that instruction; and, thirdly, what was the result? I think it is completely out of order for civil servants to give instructions. We as a committee of Parliament can ask for any documents. If a civil servant has indeed

done that then they have been acting in a very curious way and there must be a very strong reason for wanting to do so. One is very suspicious about what those documents are. Who was it, what documents were they, and why?

Professor Bourne: I cannot answer the question as to who specifically it was because of course this was all handled through the secretary of the group.

Q343 Mr Gray: That is quite an important point from the point of view of procedure. Perhaps you could kindly write to the committee and tell us three things. This is a very important point on which I feel very strongly. We need to know in detail: first, which documents you were instructed not to give the committee; second, which civil servants it was who gave that instruction; and, third, what their reasoning was. Would you kindly give us that in writing?

Professor Bourne: I can give it now. Here are the documents.

Q344 Mr Gray: Would you kindly give that to us in writing, Professor Bourne. These are frightfully important points. We really need to know in very precise detail so that we can follow it up. It completely breaches all rules of this great Parliament of ours to have done so. Perhaps you could very kindly write to the committee on that point.

Professor Bourne: Could you ask your Clerk to remind me what you want of the three points that are being made?

Q345 Chairman: We will put that in writing. Let us move on to your reaction to Sir David King's report. I will ask David Drew to open up with more detailed questions, but I just want to ask you one specific one. You made a lot of play in your response to the fact that all of your work was peer-reviewed, some of it in the very best journals. Professor Denis Mollison has been in touch by email with the committee to reaffirm that situation. Can I ask you: in terms of the peer review that your work had, did anybody raise any of the criticisms of a statistical nature which reflect the comments in Sir David's report when he queries some of the approaches that you took?

Professor Bourne: No. Can I go through some of how we got to this position? I have not had the opportunity of discussing the report with all of the group. We only saw this on Monday afternoon just before it was released into the public domain. A couple of the group were away. I have discussed it with my colleagues here of course and with Sir David Cox. I think it is fair to say that we anticipated at the outset that our work would be thoroughly debated. We expected this because of the emotive issue, the size of the project we were doing and the political importance of it. We did work to very strict protocols, all of which have subsequently been published and are in the public domain. This included the analytical technology and methodology that we would use. I find it interesting that it is only in the last few weeks that I have heard that the NFBG for instance at that time hired statisticians to try to rubbish our statistical approaches. They were

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then the National Federation of Badger Groups, now the Badger Trust. They were unable to find any fault with the experimental approach that we had adopted. So these were the sorts of pressures we were under. We anticipated that. We asked Defra to appoint independent auditors and we are extremely grateful to them for this. They have been very helpful to us. You mentioned Denis Mollison, who in fact was a statistical auditor appointed by Defra. The auditors reported not to us but to Defra. Again, all those reports are in the public domain. We also endeavoured to get all our work published as we went along and as the results came through and as we had permission to release these, in high quality, peer reviewed journals. That is the only way you are going to get science out in the public domain without it being questioned or rubbished. Peer review is absolutely critical. You are aware that we had major publications in major international scientific journals. These journals do present the opportunity for feedback—letters and commentary—which is subsequently peer reviewed. No peer-reviewed criticism has appeared in any of the journals. We have seen of course, as you will have, letters and commentary in journals which have been non-peer-reviewed. There is a commentary, you will recall, criticising the reactive cull that appeared in *The Veterinary Record* recently. We did see that commentary in March, so you must draw your own conclusions. It commented on our paper in *Nature* but there was no subsequent publication in *Nature* of that commentary. Those are the steps that we have taken. The other point I would make is that throughout this period all our papers have been considered and approved by Defra prior to publication.

Q346 Mr Williams: The criticism, though, that was made of the report was not that the science was questionable or that it was not secure and un-peer-reviewed but that the conclusions that were drawn from it and then the recommendations that a cull would not be financially effective were the basis of the criticism. Would you reflect on that because while the science was peer-reviewed, the taking forward of the results and making the recommendations was the key issue and the one that did not have exactly the same substance.

Professor Bourne: The point you make is very critical and pertinent. We wrote a scientific document and the interpretation was our interpretation of the scientific data. That is the whole point of it. It was the scientific data that was interpreted by us and this is the scientific data and the presentation of that is now being questioned in the King report. Clearly, we will respond to that. That is the critical point that you have made. We were interpreting scientific data. We put it in the report in a way so that if others wished to criticise that data, as indeed in the publications they are able to do, there were channels for those criticisms which required scientific peer review for it to be meaningful. Without scientific peer review, it becomes gossip.

Q347 Mr Drew: There are particular issues which I wish to address with you rather than ask you what your reaction to the King report is, which I imagine is largely unrepeatable anyway.

Professor Bourne: That is not true, if I may say so. We do have a reaction but it is very repeatable.

Q348 Mr Drew: I do not know if you have the King report in front of you. I would like to look very quickly at paragraph 24. I will try to paraphrase it and you will tell me if you think that my paraphrase is a reasonable appraisal. This pours scorn on your methodology with regard to the proactive cull and what you were able to deem from that. Basically, it is alleging that in a sense the four badger removal periods or the four occasions you removed badgers was the very minimum and if more removals had been possible, that intimates there could have been a different set of results. You have always been very robust with us by saying that although foot and mouth did interfere with what you were doing, you would stand by the methodology, the statistical analysis, that you took from that set of results you had from that methodology. What is your reaction to paragraph 24?

Professor Bourne: There was a variation in the number of culls that took place across trial areas which varies from seven to four, but nonetheless there was a consistency in the results and the data from these culled areas. Perhaps Christl would like to comment on that.

Q349 Mr Drew: I will try again. Do you think that is a fair criticism of your results or do you think that is a very unfair criticism?

Professor Donnelly: There is certainly a fair point that it would have been very interesting to see what could have happened with more culls. On the basis of what data we had available, we have been able to estimate here and we estimated an 11.2% increase with each removal. In terms of mathematical modelling, it would be very difficult to go beyond estimating something like that, an increase with each cull, on the basis of a mathematical model unless we knew more about the transmission mechanisms. While it would be possible to construct mathematical models to extrapolate to further culls they would have to have information on whether perturbation was happening, what its impacts were, how the risks related to the number of badgers per square kilometre and what the immigration was, all these things would be extremely difficult to know. My guess is that you could construct mathematical models that could give you different effects based on parameters that you do not know. They would be highly sensitive to this. We did not extrapolate beyond the four.

Q350 Mr Drew: Is that from another group of scientists a perfectly fair criticism in terms of the methodology you applied or is it unfair in the sense that this is something that is trying to interpret from opinion rather than a scientific basis?

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Professor Woodroffe: I want to make two points on this issue. The first is that the statement that in practice most of the areas had only four removal operations over five or six years is factually incorrect. The average was 5.1 removals. To say there were four removals is inaccurate. It is unfortunate that small mistakes like that pervade this document. I also want to draw attention to the fact that although the whole report sets great store by extrapolating from these trends a temporal trend, they also extrapolate from trends in space. As I say, it is of borderline statistical significance. It is not quite a significant effect and yet great credence is given to this, whereas there are other aspects of the study—I am thinking especially of the ecological evidence providing the mechanism whereby we are now convinced on the basis of a great wealth of highly consistent ecological data—that provide a mechanism whereby these sorts of detrimental effects that we observed did occur. All of that is dismissed as unconvincing; they do not even cite any of the peer-reviewed scientific papers that present that body of information. That is the reason I have brought for the committee copies of those papers to allow you to see them. It is useful to think about this particular issue in the context of what I think in this report is a highly inconsistent standard against which effects are being judged. This temporal trend is used and interpreted and taken as a good convincing effect, and yet other aspects of our work, which in many ways have greater reason to be convincing, have been dismissed. Personally, I do not think that this is a terribly fair judgment of our work, but it is a lot less unfair than some other parts of the report which have dismissed very strong pieces of science that have been published in internationally acclaimed scientific journals.

Professor Bourne: I think there is a real difficulty here, David, with this report in that it was clearly hastily written and because of that it is very superficial; it is also very selective. What is so important is that you do not just cherry pick bits of data from the report but that you look at the totality of the data that we presented as a result of gathering this over 10 years to draw your conclusions. One can select bits and pieces of data as they have done here, but it gives a very superficial sound bite, which is totally inappropriate to considering the data in its totality. That could be done, of course. Another group would have to spend an awful lot of time doing it if they wished to do so but this document brings no new science to the table. I identified no areas that had not been considered by us and highlighted in our report or in the various papers and supplementary evidence that we have provided associated with those papers.

Chairman: I am going to stop our questioning of your good self and your colleagues for the time being. I am conscious that Sir David King has a longstanding engagement, a lecture, and he cannot keep an audience of thousands waiting. I do not want to lose a minute of our opportunity to talk to him about his findings. I hope, John, that you and your colleagues will stay on because we want to ask you further questions. There may be things that you would like to put before the committee in the light of what Sir David has to say. Sir David, I know you are not yet on the witness stand. I do not know if Professor Woolhouse, who is with you, is able to remain as well because it would be good from your side if you heard what was being said. We always like to be fair and balanced in what we are doing. It would be helpful if he could remain.

Letter dated 20 November 2007, from Professor John Bourne CBE, Former Chairman of the Independent Group on Cattle TB

RE: BADGERS AND CATTLE TB: EVIDENCE SESSION, WEDNESDAY 24 OCTOBER 2007

I was asked by the Chairman how I reacted to Lord Rooker's comments when our report came out. I replied that I was not sure that the comments reported in the *Farmers' Guardian* (29 June 2007) could be attributed to Lord Rooker.¹ However, I have since been reliably informed that they were an accurate transcription of tape-recorded comments. Similar comments made in the House of Lords (26 July 2007) have also been brought to my attention.

Since these comments from the Minister directly relate to the conduct of the ISG and the output of the science programme on which ISG advised Ministers, I would agree with the Chairman of Efra that they warrant a response.

The essence of Lord Rooker's reported comments was that "we" (Defra Ministers?) were not adequately informed about the scientific findings presented in the report and our interpretation of them; that scientific targets with respect to "—the extent of TB in the badger population, how badgers transmit TB to cattle, that we might have a vaccine" had not been met. Lord Rooker also apparently criticised the ISG for "deviating off into practical and financial issues, which was not really what we were asked to deal with"; and also "not providing cost benefits"!

¹ *Farmers' Guardian*, 29 June 2007, "Rooker 'open-minded' on badger cull despite report".

I wish to make the following comments on the particular issues raised by Lord Rooker:

1. *Communication of scientific findings to Ministers*

This has been fully covered in our response to Efra. Documents clearly demonstrate that emerging scientific findings were shared and discussed with Defra officials and reported to Ministers throughout the period of our work. Our final conclusions were reported to Ministers almost four weeks before our report was published. My letter to Mr Bradshaw (Ref TBX 284; 23 May 2007; now released to Efra²) included the statement that “On the basis of a careful review of all the available evidence, we conclude that badger culling is unlikely to meaningfully contribute to the future control of cattle TB in Britain” and “We therefore recommend that future control strategies focus on cattle measures . . .”. This is consistent with advice presented to Ministers following the release of data from proactively culled RBCT areas to Ministers in late 2005.

It would appear that Lord Rooker was not informed of these exchanges.

2. *Route of Transmission*

Understanding the route of transmission of disease was not a specific objective of the trial, though it was recognized it would be helpful particularly with respect to providing advice on biosecurity aspects of disease control and was covered within our wider recommendations to Defra on associated research.

It was identified as a key question in our first report to Ministers (Bourne *et al*, 1998), albeit the last of a long list of questions that would need to be addressed, in Paragraph 1.8 (page 3) and with an appropriate caveat:

“A further key question, which would be extremely difficult to answer, relates to the route of transmission: if transmission of *M. bovis* from badgers to cattle occurs, is it by—

- direct contact,
- aerosol as a consequence of close proximity, or
- contamination of pasture or other cattle feed”

In our second report (paragraph 2.12 D, Bourne *et al*, 1999), the last of a long list of questions asked, “What are the possible and most probable routes of transmission of infection to, within and between cattle herds—urine, faeces, respiratory discharge?”

Direct transmission experiments could not be conducted in badgers since no facilities were available for this work. However studies, funded by Defra, were conducted in cattle. One of these studies involving the contamination of food stuff was uninformative, but others, particularly pathogenesis and pathology studies in cattle and badgers, have provided useful evidence of actual and likely transmission routes. These findings were routinely reported to Defra by the scientists involved. They were also presented and commented on in Bourne *et al* (2007) chapters 4, 7 and Appendix I, and in Jenkins *et al* (in press). It is surprising that Lord Rooker was not aware of these reported findings, which were discussed in detail with Defra colleagues prior to publication.

3. *Vaccine development*

In its second report to Ministers (Bourne *et al*, 1999) the ISG “recognized the need for effective vaccines and strongly supports the implementation of the vaccine research programme”. We added “Although the vaccine programme is being undertaken by leading experts in the field, we would caution that success cannot be guaranteed, even in the long term”.

In a further report commissioned by Defra (Bourne *et al*, 2003), we comment (paragraph 1.11) “The option of the use of vaccines should in our view be retained—we have identified areas of research that we believe are necessary to ensure that progress towards taking a vaccine into the field is optimised. It is, nonetheless, clear that there is no quick fix or short cut that can be taken to speedily put in place a vaccine control policy option. In the short, or even longer term, alternative control options will need to be adopted in order to achieve better control of the disease in cattle”.

It is disingenuous to us and to scientists engaged in these projects for Lord Rooker to have made such ill-informed and unhelpful remarks.

4. *Practical issues*

“The RBCT was designed to test the effect on the incidence of bovine TB of two different approaches to badger culling, each of which represented a potential *practical* policy option—two culling strategies implemented under field conditions and in a way that could be extended into a viable policy” (paragraph 1.4, Bourne *et al*, 2004).

² Not printed.

The complex relationship between badger abundance and cattle TB risks, as revealed by our work, means that the practical issues—which determine how, where, when, and on what scale badger culling might be conducted—are absolutely critical in determining whether culling would reduce or increase the incidence of cattle TB.

We consider it was not only a clear part of our remit, but our responsibility, to comment and advise on a number of culling approaches that might be considered to cull badgers. I have no doubt that we would have been criticized had we not done so.

5. *Economics*

The issue of “Would these badger control strategies be cost effective?” (paragraph 1.6, Bourne *et al*, 1998) was discussed by the ISG with MAFF (now Defra) before the RBCT was launched. The outcome of this was the subsequent appointment by the Minister of an agricultural economist to the ISG, with a responsibility for economic matters. The need for economic evaluation and the research requirements associated with it were considered in detail in our second report to Ministers (paragraph 7.7.1 and appendix D, Bourne *et al*, 1999). The Group had a clear remit from Ministers to take into account an economic assessment of “—possible sustainable TB control policies”. Lord Rooker, then Mr. Rooker, made this appointment.

Throughout our work we aimed “to present Ministers with a range of scientifically-based policy options which will be technically, environmentally, socially and economically acceptable” (Bourne *et al*, 1998).

6. *Extent of TB in the badger population*

Evidence on the extent of TB in badgers in trial areas and in the counties adjacent to trial areas is considered in detail in several papers and summarised in the ISG final report (Bourne *et al*, 2007) with detailed pathology characterised in Jenkins *et al* (in press). As with other trials and associated datasets, this was previously made available to Defra and it is surprising that Lord Rooker was unaware of it.

In the light of the ISG’s consistent practice throughout of developing its work in close association with the relevant officials and scientists in MAFF and Defra, and discussing its findings with them, I find it inexplicable that Lord Rooker could be reported as having made such a number of ill-informed, and misleading, comments that reflect badly not only on the ISG but also on other scientists engaged in work for Defra.

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Memorandum submitted by Professor Denis Mollison

COMMENTS ON THE CHIEF SCIENTIFIC ADVISER'S REPORT, "BOVINE TB IN CATTLE AND BADGERS", PUBLISHED ON 22 OCTOBER 2007

I write as the Independent Statistical Auditor of Defra's Randomised Badger Culling Trial (RBCT).³

The Final Report of the Independent Scientific Group (ISG) on the RBCT was painstaking, expert and balanced, and I commended it to Ministers as an exemplar of how to bring high quality science into public decision-making. The ISG's main modelling and statistical analyses have been published in the highest quality peer-reviewed journals, such as *Nature* and the *Proceedings of the National Academy of Science*.

In stark contrast, the Chief Scientific Adviser's comments published yesterday, as a report *Bovine TB in cattle and badgers*, would not have passed my audit. It is unbalanced and inexpert.

First, one has to question why he had to assemble an "expert group" to comment on the ISG's Report at all, when its analysis was of such quality and its conclusions so clear. It undermines the concept of independent scientific advice when it is filtered in this way.

Next, his report is mainly concerned with detailed discussion of complex statistical modelling and data analysis issues. Yet neither he nor any of his "expert" group have expertise in this area comparable with Professors Cox and Donnelly of the ISG.⁴

One consistent theme of Sir David King's report is its attempt to play down or dismiss the ISG's findings of detrimental effects near the edge of culled areas. These range from picking apart statistical fine details in a textbook example of special pleading (para. 43), to their wishful thinking that disruption (under a continuing culling programme) may be transient (para. 37). They even suggest there may still be a role for the reactive strategy (para 50), contrary to the conclusions of the ISG accepted by Ministers in 2003.

Their epidemiological analysis is muddled in its discussion of the basic concept of R_0 (paras 9–11 and Annex 2); and on a substantive point, the results of Cox *et al* indicated an R_0 of about 1.1 not for cattle-to-cattle but for the whole cattle-badger system, suggesting that cattle controls on their own might well be sufficient to reduce this overall transmission parameter R_0 to a value less than 1, and thus bring the disease into decline.

Nor do they discuss the economics: the ISG concluded that the proactive strategy, if carried out over large enough areas (of the order of 300 sq km), should have a beneficial effect, but estimated this not to be cost-effective.

Finally, the language used is not always careful. For example, "Strong action needs to be taken now" (para 4) sounds good, but if this refers to badger culling, the ISG report makes clear that in many circumstances "strong action" would be likely to make matters worse.

October 2007

Witnesses: **Professor Sir David King**, ScD, FRS, Government Chief Scientific Adviser and Head of the Government Office for Science, and **Professor Mark Woolhouse**, Epidemiologist, Centre for Tropical Veterinary Medicine, University of Edinburgh, Member of the Group of Experts, gave evidence.

Q351 Chairman: Thank you, Sir David, for coming at short notice to talk to us. It was something of a surprise to us that you were going to produce an additional blockbuster report to add to the growing mountain of commentary in this area. Nonetheless, it is an important document. We are grateful to you for making yourself available so quickly for some public scrutiny of what you have said. I gather that you wanted to make a short presentation to the committee on your findings. In that context, if you are able to do it in five minutes, we would be grateful if you could condense your work into such a short time space, but we are up against the clock. If you would like to give us a summary, that would be a good way to start.

Sir David King: Chairman, I am going to start by just explaining my role as Chief Scientific Adviser. It is to

provide independent advice to government, particularly on important issues where science is concerned. It is customary for members of the Cabinet to contact me for advice on a whole range of issues, and that is what I have been doing for the last seven years. I give you one example where I brought in the entire team who had been working for seven or eight years, and this was the question of scrapie in sheep and whether or not there was BSE in those animals. Those people had been deeply involved in that for seven or eight years. I questioned them for a day and during that process discovered that no DNA test had been conducted on the sample they had received. When I sent that out for testing, we discovered they had been testing the wrong barrel of sheep brains, and it turned out that they had been testing bovine and not ovine material. Let me

³ My final audit report can be found at http://www.defra.gov.uk/animalh/tb/isg/pdf/statsaudit_rpt0607.pdf

⁴ Professor Sir David Cox is of particular international distinction, including for his many books and papers on statistical modelling, and for his integrity and the care and balance he brings to any argument. He is a past President of the International Statistical Institute (http://www.stats.ox.ac.uk/people/academic_staff/david_cox). Professor Christl Donnelly is internationally recognised for her experience and abilities in the detailed statistical analysis of infectious disease data, and is also most careful and balanced in presenting her conclusions (<http://www1.imperial.ac.uk/medicine/people/c.donnelly/>).

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suggest that that was a critically important outcome of my challenging process. I am just giving you that one example. Following publication of the ISG report, I was approached by the Secretary of State and agreed with him that I would undertake a short objective assessment of the key scientific issues in relation to the role that badger removal could play in controlling and reducing levels of TB in cattle in England. I want to stress that I was asked to make comment on scientific issues. My brief did not extend to economic or other practical issues. I invited five experts to help me assess the relevant scientific evidence. They are all very well respected; many of them have been working all their lives on TB in animals. I was confident that I had a good group of people, particularly covering badger ecology, epidemiology and immunology of TB. Together we reviewed the evidence. They had the report for some weeks before we met. We met for a period from 9 a.m. through till the end of that day. I wanted them to sleep on it, so we met again for two hours the next morning. Some of the members were present for some of the time. The Australian member of the committee was 12 hours out of phase with us and so we lost him around midnight Australian time, but he was there the next morning. I am very glad that one of the members of that group, Professor Mark Woolhouse, is here. He is from the Centre for Infectious Diseases in Edinburgh. He is an epidemiologist with whom I have worked previously. The main evidence base to which we referred was of course the ISG final report and the results from the RBCT proactive trials. This report was the culmination of nearly 10 years of work by the ISG on cattle TB. I congratulate John Bourne and the group for producing an excellent and comprehensive report, which adds enormously to the scientific evidence about TB in cattle and the role that badgers play in the spread of the disease. The conclusions in my report are not very different from those that the ISG reached, particularly in terms of the scientific content of their report. Let me quote from a recent publication, *The International Journal of Infectious Diseases* that has just appeared but was submitted on 3 April this year. Three of the authors are sitting behind me, so it is by John Bourne, Christl Donnelly and others. I quote directly: "Results confirmed that badger culling is only likely to be beneficial if conducted systematically over large areas and sustained over several years." I quote that because I want to indicate that I agree with the ISG that badgers are a continuing source of infection for cattle and vice versa. The ISG figures show that badgers could account for up to 40% of cattle breakdown in some areas but I do not agree that their data supports a conclusion that badger culling cannot contribute to the control of TB in cattle in Britain. As pointed out in the ISG report, culling over large areas and over a significant period of time would be effective. I am drawing on the information in that report, Chairman. So the conclusions that I draw from the data—I say "I draw", I am naming my science panel but nevertheless I take the responsibility for the conclusions—is that badger removal alongside cattle controls would very likely

play an important role in controlling TB in cattle in those areas where there is a consistently high level of TB in cattle. I realise that I am not going to be able to give you the body of what I was going to say, but let me leap to the conclusion. Although the scientific evidence is not as clear-cut as one would like, I feel that more research would have added to a reduction in the uncertainties, but with the incidence of TB in cattle doubling every four and a half years and extending over the country, now is the time to stop this upward trend. It has a very important impact on our farming community. Britain's biggest endemic animal health issue is TB in cattle. In my view, the data from the ISG report would lead to the clear conclusion that badger removal alongside cattle measures would make a significant contribution to the control of cattle TB in those areas where it is highly persistent. Removal must be done effectively over large areas and over a sustained period of time. That is the basis, the meat, of that letter that I have sent to the Secretary of State.

Q352 Chairman: Just for the record, when specifically did David Miliband ask you to undertake this work?

Sir David King: The publication of the ISG report was 18 June. It was in that week.

Q353 Chairman: Did he write some formal terms of reference?

Sir David King: The terms of reference were that I should base my advice on the science.

Q354 Chairman: Did he define the parameters of your work?

Sir David King: Beyond that, no; he left it to me to determine how I would operate, so the calling of that small group of scientists was my normal method of operation in such a circumstance.

Q355 Chairman: Your work has been solely, if you like, discussion and paper-based. You have not actually gone out and looked at any of the reality of what you are commenting about on the ground?

Sir David King: Our work was a commentary on a very detailed piece of work. As I say, our conclusions are based around that piece of work, but I would want to add that the experts that helped me on this report had all been engaged over a long period of time on the issue of TB in cattle.

Q356 Mr Drew: You heard my earlier exchange with the ISG group on paragraph 24, so I will not rehearse that. Can I take you to paragraph 14 in your report and the last sentence? Again I am paraphrasing and pick me up if I am in any way misinterpreting the evidence. What you are basically saying is that where there is a higher incidence of badgers, you can map that out in terms of a higher incidence of bovine TB in cattle. Can you quote scientific evidence to prove that? Can you also refer to the evidence from the RTA work that has been going on for a long period of time, which actually was completely confusing and did not really in any way prove that there were badger hot spots if you

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were to take the relationship between the level of TB in badgers, which was a steady 15 to 17%, compared to the areas where there is a much higher level of incidence of TB in cattle? In a sense, this is the scientific rationale on which you are basing your findings.

Sir David King: I do not think there is any disagreement on the final part of that sentence that there is a good indication of a wildlife reservoir of TB infection.

Q357 Mr Drew: That is not the problem. There is a problem with the densities of badgers because from my understanding, having been there on a number of occasions, the Woodchester Project has categorically proven that where there is a high number of badgers there is no greater incidence of bovine TB in cattle.

Professor Woolhouse: Could I comment on that? There clearly is a very complicated relationship between badger density and the level of infection in badgers. The Independent Scientific Group's work has been very important in trying to elucidate that relationship. The fact that that relationship is complicated and perhaps not a simple linear one as you are implying certainly does not mean there is not a link or an association which is very clear here between the level of infection or the infection of badgers and infection in cattle. Indeed the ISG's other group in a paper by Rosie Woodroffe published in the PNAS a few years ago—and she can comment in a few minutes on that—would support that association. What we have been arguing about for decades of course is in which direction does the actual link go. I do not think there is any doubt about the association.

Q358 Mr Drew: You are happy to have this paper peer reviewed in the due course of time to clarify some of those issues in terms of the statements you have made?

Professor Woolhouse: Whatever mechanism is felt appropriate for reviewing that, including of course a reply from the ISG.

Q359 Mr Williams: You have told us that having got together your group of experts, you had a meeting over one day and then another meeting the next morning, and one of your colleagues was contributing over a phone line. Do you think that is a satisfactory way of conducting what is a very important piece of work or should it have been given more opportunity for consideration?

Sir David King: Let me once again explain that the members of that group had the ISG report for at least three weeks before we met and, more importantly, the members of that group were very much aware of the papers that had been published from the work that has already been referred to by John Bourne, the papers that had been published over the period of the work itself. It is not as if the work of the report was new to the people who were helping to advise me on this. During that three-week period, my office received from those experts their own comments on the ISG report. Prior to the

meeting, they were working on it with my own team to see that we made the best possible use of that full day. I have to say it was a very full day. We carried right through over dinner that evening and, as I say, met again for two hours the next morning. I think that, given that the Secretary of State had asked me for a brief commentary, that was probably what was needed.

Q360 Mr Williams: You say your consideration was based on the ISG report. Did you gather any other scientific evidence to consider when you were reviewing that?

Sir David King: As I say, we had experts who are very much up to scratch with publications in the literature right up to the present time. Their knowledge was absolutely crucial to this, not my own and not the papers I was reading alone but their very broad-based knowledge.

Q361 Mr Williams: Did that include an assessment of the work in Ireland on the Four Areas trial?

Sir David King: Yes, it did, so one of our experts was actually from Ireland and was well versed in that work.

Q362 Mr Williams: What conclusions did you draw from that work that you were able to feed into your consideration of the ISG?

Sir David King: We were aware of the fact that the Irish had taken the decision to have a badger cull policy. I think we were also aware of the fact that the incidence of TB in cattle has been reduced in Ireland, both through that and through the better controls on TB in cattle, and at the same time we are aware of the fact that badger behaviour in Ireland is different because of lower densities of badgers, different movement patterns amongst badgers, and of course there is a different approach within Ireland to the methodology of culling, an approach that would not be available to us.

Q363 Mr Williams: You say that the parameters set by the Secretary of State were that you had to consider these issues with regard to the scientific evidence that was available to you, yet you come to this recommendation that strong action needs to be taken now. Was that the expectation of the type of advice that was expected by the Secretary of State when he asked you to carry out this work?

Sir David King: Is it possible to distribute a map because I think this really underlies the basis of it?

Q364 Chairman: Yes, it is possible to give us guidance.

Sir David King: The map shows the distribution density of the breakdown of cattle herds in Britain with TB.⁴

⁴ *Animal Health 2006: The Report of the Chief Veterinary Officer*, p37 (<http://www.defra.gov.uk/animalh/cvo/report/2006/report—2006-full.pdf>)

Q365 Chairman: Before you go on, on one small point of definition in paragraph 3, you said, “I have considered whether the removal (killing) of badgers in areas of high TB prevalence might . . .” What is the definition of “high”?

Sir David King: Fortunately, that is effectively shown on this map. What we are showing in the map is simply the herd TB prevalence in the UK. The red dots indicate that prevalence at the present time. This is spreading at the rate of about an additional 18% per annum. This means we have that doubling period I previously referred to as four and a half years. This spread has occurred consistently since about 1972. What we can anticipate is that therefore in four and a half years’ time this will have spread beyond the areas currently indicated there. There are hot spots which have been referred to. We believe those hot spots can be traced back to cattle movements, particularly cattle movements following a foot-and-mouth disease epidemic when people were restocking cattle. We certainly do not attribute the hot spots, if I go back to the previous question, to spreading through badgers. That would be cattle movement and quite possibly cattle-to-badger infection occurring in those areas. The question was put to me: effectively, was my advice concerning the need for action soon based on science? This really is my scientific response.

Q366 Lynne Jones: Could I clarify that your report was submitted to David Miliband on 30 July?

Sir David King: Yes.

Q367 Lynne Jones: Would you care to comment on why it has taken until this Monday to make that report public, or even to make it available to the ISG?

Sir David King: That is a question that should be put, I think, to the Secretary of State. My reports to Government are always made with the knowledge in Government that I am going to put my reports into the public domain. I have done that now for six years very consistently on the basis that if I am going to maintain public trust, then everything that I do in terms of advice to Government should be available for external judgment. The Secretary of State knew that I would wish to put this into the public domain, but I have always said, “It is your call when it actually is put into the public domain”.

Q368 Lynne Jones: Returning to the point you have just made, I am afraid I do not quite follow you. I agree we do have a very difficult situation as regards bovine TB. Whether or not strong, as you put it, action is advisable would depend on whether that is going to make it any better. I am not at all clear from what you have just said. You have just shown us there are areas where the infections are higher but I do not really think that answers the question as to why that means that the report of the ISG should be overturned.

Sir David King: It would have been better if I had had maps showing the spread over the last 15 years. We do have such maps and we can provide them for you. What I am really trying to say is that it is

spreading geographically. It is not only numbers of cattle herds; it is also spreading geographically across the country from the south-west towards Gloucestershire and back into Wales. That spread has occurred. I am simply saying that we should not wait for another 10 years of experimentation. This is the time for decision making and action.

Q369 Lynne Jones: But not if you are going to do something that is going to make it worse. This is the question, is it not?

Sir David King: Absolutely, and I would certainly not be advising that we do something that would make it worse. As I have indicated to you, by reading that publication from members of the ISG, the ISG do not believe that the action I am proposing would make it worse.

Q370 Lynne Jones: May I say that that is not strictly true. The very same comment that you made, which you say was published in March of this year, was actually published in March of 2006—I have it in front of me in *The Veterinary Record*—at a meeting in Bristol at which Professor Dan Collins, who was your expert from Ireland, was also present. I think that the ISG would dispute—they will be able to make the point if I have this wrong—that a large area is very much larger than 100 square kilometres, which would not be considered to be a large area, certainly in terms of the Irish work.

Professor Woolhouse: The areas in the Irish trial were exactly in the range of 200 to 300 square kilometres. The ISG report does extrapolate their figures up to 300 square kilometres, so there is a consistency there. The ISG make a number of points, and this was brought up earlier, about comparing the Irish trial with the RBCT. I agree that the comments are different. I agree with the statements the ISG makes there. I think it is very important to try to understand these differences. One candidate for understanding those differences is that the Irish trials took place with a larger area than the RBCT trials.

Q371 Lynne Jones: Whether we can replicate that here is a moot point, is it not?

Professor Woolhouse: It is a practical point but the scientific evidence in the view of the people they assembled suggested, let us put it this way, that if removal of badgers or any other badger control is going to be effective, it has to be implemented over larger scales and for longer time periods than the units of study that the RBCT implemented. The RBCT work was not, as I understand it—and I was part of the Godfray Committee that reported to you in 2004 on this issue—a practice mock-up of an actual bovine TB control programme. Initially it was a research experiment to try to understand better this link between cattle and badger TB. It is not surprising, scientifically or on any other basis, that you will want to move beyond the immediate RBCT trial in order to design an effective national bovine TB control programme.

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Q372 Lynne Jones: The work stopped in 2003 after the initial 2003 report.

Professor Woolhouse: Only for one arm of the trial of the RCBT.

Q373 Lynne Jones: I am referring to the work of the ISG. You criticise them in one of your paragraphs, I think paragraph 24, and say that the trial should have continued for longer. Of course it was Defra that decided to discontinue that trial.

Professor Woolhouse: The issue of the reactive cull trial has been debated many times. I think there is a general consensus that it is unfortunate that that trial was curtailed quite early. Nonetheless, we do have some valuable data now from the proactive culling trial. As a scientist at this table, in no sense is Sir David's report intended to rubbish the work of the extremely competent group that the ISG represents. It is not supposed to do that. As Sir David made very clear, in fact I personally and the other members of the group agreed with the data and what the report suggested up to the point where they conclude that there is no role for removal or controlling badgers. I would like to hear their views on that. We agree with their assessment that if it is going to be effective, it has to be over large areas and for a longer time.

Lynne Jones: It will boil down to the practicalities of achieving that, which we will go on to discuss.

Q374 Dan Rogerson: Where your part company is on whether you feel it is your role to say it is possible or not just purely on the science. If something can be done on a big enough scale that is humane and of the relevant intensity, you feel it could make a contribution. That is where you find the major distinction between the ISG report and—

Professor Woolhouse: There is a number of publications making the same extrapolation.

Sir David King: What we are all agreed on as scientists is that if we really want to eliminate TB in cattle herds, then it is not going to happen while there is still TB in wildlife. While there is still a reservoir of TB in wildlife, it will come back into cattle herds continuously.

Q375 Mr Drew: What about deer?

Sir David King: I said wildlife.

Q376 Mr Drew: Deer are wildlife and out there feeding.

Professor Woolhouse: The main reservoir of bovine TB in wildlife is in badgers. There may be other reservoirs too.

Q377 Mr Drew: You have never tested them.

Professor Woolhouse: The main reservoir is badgers and that clearly has to be the initial one to consider.

Q378 Patrick Hall: Sir David, when you opened your presentation, you gave us an example of your role of questioning and challenging a group of people with regard to scrapie. Did you do that after you had been asked to carry out the work that you have just done? Did you do that with regard to the

ISG itself? Did you call them in and discuss and challenge not only the science but the very important conclusions and interpretation?

Sir David King: In this instance, it was my judgment that this was not necessary because we had before us the publications and a very detailed report. As a matter of fact, as has been made very clear I think today, we were not challenging the scientific basis of those reports. We have provided a commentary on them but we are not challenging those reports.

Q379 Patrick Hall: You are challenging the interpretation of the scientific data. Is that correct?

Sir David King: I think it would be fair to say that in our advice we have stayed outside the area of including economics and, if you like, practicality issues. What we are actually saying is exactly the same as the ISG concludes. If this is done in large enough areas, if we can reduce perturbation of badgers (movement of badgers) by using wherever possible natural boundaries, and if we can do this over a sustained period of time, as said in the report, we would expect that the incidence of TB in cattle would be reduced, and we would need to couple this with action on cattle as well.

Q380 Patrick Hall: But the area of disagreement is in terms of the interpretation of the data. You are not undermining the scientific data or the methodology but the conclusions. That is what matters. It is the conclusions and therefore what is done that matters. I would have thought it would have been consistent with your role that you would challenge and question and discuss the conclusions that have come from the interpretation of the data. You have not done that. You have not done that perhaps because there was not a lot of time. I wanted to establish whether you had done that or not, and you have not.

Professor Woolhouse: Professor Bourne was strongly suggesting that there was an attempt to undermine the statistical analysis of other data, and that is emphatically not the case. You are quite right; it is the interpretation, particularly the interpretation going beyond the actual study that they were reporting on that was being discussed. It is what we do next. This report has been submitted; it tells us a lot. The conclusions are equivocal. In fact, the Godfray Committee said in 2004 that they were going to be. You were warned in 2004 that we were going to get equivocal results from this trial. What then do we move on to? What does the scientific evidence point to next?

Q381 David Taylor: You say you are not challenging the scientific approach of the ISG, but in paragraph 37 of your report, in the second sentence, when talking about whether or not the disruption of badgers was a permanent effect, you say: "However, there is a reasonable possibility that the disruption is transient." You are taking out altogether the ISG's conclusion that it has a permanent effect. Secondly, in paragraph 41 you comment on the ISG's statement that "badger culling cannot meaningfully contribute to the control of cattle TB in Britain". You just say: "However, the data do not support

such an unqualified conclusion.” You are criticising their conclusions without really giving the scientific background to that. Thirdly and finally, at one point you talk about hard geographical boundaries without adducing any scientific evidence whatsoever, for instance that arable land of at least one kilometre wide—your suggestion—is any barrier to badger movement or indeed that rivers, motorways and so on act in the ways that they do and suggest they do. You are criticising them for things which you then go on and repeat yourself.

Professor Woolhouse: The rivers, motorways and coastlines point is actually raised in the ISG report. There are far fewer inconsistencies than you are implying between the science and—

Q382 Chairman: You say that but you do not, if you like, qualify the difference. You talk about the same kinds of hard boundaries which the ISG did but then say that if they do not exist, perhaps some soft boundaries in the operative kilometre-wide land in certain areas will probably do so, but there is no quantification scientifically, mathematically or in any way as to the difference between the effects of these different types of boundaries. It is almost saying that any boundary will do that as long as it is above 100 square kilometres area-wise.

Sir David King: Can I just try to explain that, Chairman? The existence of a boundary we would all agree will reduce the impact of the perturbation. That is the important point we are making, not that it will eliminate it but that it will reduce it and anything that is done to reduce the perturbation is going to reduce the negative impact of the cull. Whether that boundary is a river, an ocean or a motorway, it is going to reduce it. I do not think either, Chairman, that anyone would argue that a large strip of arable land would be a good way to avoid these effects because the effects arise from the in movement of badgers from outside the cull area. If we have no cattle outside the cull area, then of course there is no effect.

Q383 Chairman: In paragraph 28, and I do not want to labour the point, you again deal with this perturbation effect almost by saying that the numbers of perturbed badgers will go down if you increase the frequency of culling within your defined areas. You almost seem to be saying that. Maybe I have misunderstood it.

Professor Woolhouse: I do not think that is right. That is to do with the possible transient nature and negative effect. Going back to your previous point, another difference of interpretation between the Irish trial and the RBCT is that the Irish trial was actually chosen with natural barriers in mind. That has been published as the reason why there are those different results. The idea that barriers would help ameliorate any negative effect I think is quite well supported.

Q384 Chairman: One of the things that is increasingly difficult for all of us to take on board is that when we look at Professor Mollison’s critique of what you have said, he for example talked in

general terms about what you did by saying that it was unbalanced and inexperienced. He goes on to comment: “Next, his report is mainly concerned with detailed discussion of complex statistical modelling and data analysis issues. Yet neither he nor any of his ‘expert’ group have expertise in this area comparable with Professors Cox and Donnelly of the ISG.” Finally, there is quite a long paragraph in which he questions your epidemiological analysis. He describes it as “muddled in its discussion of the basic concept of R_0 and on a substantive point, the result of Cox *et al* indicated an R_0 of” He is giving you a really good panning in terms of your methodology and approach. He was the independent statistical auditor for the Randomised Badger Culling Trial for seven years, from 2000 to 2007. If you were inviting peer review, you appear to have got it.

Sir David King: This is not peer review, Chairman. This is mud slinging. What you have just quoted are attacks on personalities. I am very happy to have details of what we have said approached in a peer-review style. Look at the list of people who assisted me: Tim Roper, ecologist and a badger expert; Douglas Young, immunologist, a microbiologist from Imperial College; Mark Woolhouse, one of the country’s leading epidemiologists; Dan Collins, veterinary medicine and animal clinical studies in Dublin, and again his expertise is specifically in the area of animal TB; and Paul Wood from Australia, the person who developed one of the critical tests for cattle TB and who is internationally seen to be one of the experts. To call that a group that is not expert in the area is simply totally mistaken. I am going to ask the expert on my right to make some specific comments on that.

Professor Woolhouse: You mentioned two things. You mentioned the alleged criticism of the statistical approach taken by the ISG to which Denis Mollison refers. Yes, I think there are some quibbles about some of the clarity of the presentation in the report. As I have said several times, there are no quibbles with the statistical analyses that have been done in the past. This has been challenged in the past. It was challenged by the Godfray Committee. I think those comments were taken on board at the time. No, there is not. In terms of R_0 , I do not follow Denis Mollison’s arguments entirely, but I know he understands the concept of R_0 as well as anyone else, including myself. I very much doubt there is any fundamental disagreement there.

Q385 Sir Peter Soulsby: You respond to some of the criticism and dismiss it as mud-slinging but we did hear Professor Bourne describe your report as hastily written, superficial, selective, cherry picking and sound bites. Those are fairly serious criticisms from some people who have clearly given a lot of time and effort to looking at the science behind this. You must take that that criticism seriously, surely?

Sir David King: If I had sent a paper in to be published and that was the referee’s criticism, I would be very unhappy about it for the simple reason that it has not actually gone into the specific points of disagreement. It is the same comment as

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saying these people were not experts. I say: what is it that we are saying that is under attack and then we can address it? To make very general comments like that does not enable us to address the problems that may be seen.

Q386 Sir Peter Soulsby: Looking back now at the way in which this has been handled, you spent a couple of days looking at a considerable body of research that had been published and peer reviewed over a considerable period of time. You spent a couple of days looking at it. I do not doubt the expertise of those who worked with you on it. You submitted it to the Secretary of State some months ago. You let those whose work you were criticising see this on Monday. Would you not accept that that is a somewhat inappropriate way of dealing with something as significant as this?

Sir David King: I am in danger of repeating myself. Essentially we are not disagreeing with the 10-year study to which you have referred. The science in that study has been accepted by us in making our recommendations. If we ask a basic question that was the question that Krebs was asking—“Is there now evidence that badgers are a source of cattle TB?”—the answer is “yes”. The Bourne committee makes that answer very clear and in some areas up to 40% of the incidence of TB in cattle herds can be attributed to badgers. I am quoting to you from that report, so I am not disagreeing with the science. I am simply taking the science with my colleagues and drawing a conclusion from that.

Q387 Sir Peter Soulsby: Sir David, you keep telling us that you are not disagreeing with the science but it was very evident from the words I quoted from Professor Bourne and from the evidence he gave to us earlier, and indeed from the shaking of heads and the frowns that are going on behind you, that they certainly feel that you are seriously disagreeing with the work that they have done and the conclusions that they have drawn from it. There is a difference of opinion, a distinct difference of opinion. Would it not have been better for you to have discussed those differences of opinion with the original authors and then and only then to have produced a report of this sort?

Sir David King: That is a very specific question which I can address. Would it not have been better to have discussed it with the authors? I was asked by the Secretary of State to provide him with advice so that he could ponder the issue. I deliberately brought in a small group of experts, and these are I want to stress experts who have substantial experience in the area of cattle TB, to help me to comment on this, but I stressed with those experts that it was for the Secretary of State to call when this would go public. That really is why I have not discussed it any more broadly than that.

Lynne Jones: Would it not have been better for you to have discussed it off your own bat, purely so that you could have actually been more effective in producing this report to the Secretary of State?

Chairman: We stand adjourned to go and vote.

The Committee suspended from 4.09 pm to 4.18 pm for a division in the House

Chairman: Sir David, you were going to give us your answer to the last question. We gave you a chance to think about it. If you have forgotten what it is we will move on and come back to it.

Lynne Jones: I will tell you what it was: why did you not talk to Professor Bourne about your report? It is inconceivable, if you wanted to produce the best possible report using your challenging function, that you should not have done so unless you were prevented in some way. Were you?

Q388 Chairman: Can I just add to that because, sitting here, when you are not a scientist or a statistician you have to try and make some sense of what two differing camps are saying about some data. Just to sum up, if I have understood correctly, what you have said is that the actual scientific findings, the results, if you like, of all the work in the randomised badger culling trials, and indeed the analysis of that which the ISG have produced over the last ten years, the block of data, if you like, the facts, where there is common ground, you do not disagree with, but you rather skilfully used the words to imply that there was quite a lot of agreement between the two of you by resting your case on, “We agree with the facts”. What you have ended up doing is putting your interpretation of that information before us in your report, just as the ISG did with theirs, and we are now left as lay persons saying, “How do we find out which view is right?”. I see the Minister nodding ruefully because he is going to be in the same boat as well. He can say, “I have now got the David King report, so that is all right; that is different”, or he will get notes from his officials and various other luminaries in Defra who will write up lots of words of further advice, and the poor man has to make his mind up in order to make a recommendation to the Secretary of State. We have to write a report about this, but I think where Lynne Jones is coming from is saying is there any merit, before final decisions are made, in your group meeting with the former ISG to see if there can be, hopefully, some kind of meeting of minds rather than people administering knock-out blows to each other? What about it? Is there a chance of you getting together? It is amazing what you can do in a day and a half.

Sir David King: I think, Chairman, that it is very important to establish the areas of agreement and the areas of disagreement and I wonder if I could just spend a few minutes on that.

Q389 Chairman: Yes.

Sir David King: For example, John and I were both interviewed on Radio 5 Live this week. He was asked, “If you really went for it and culled the badger would it work?”, and his reply was, “Oh, yes, it would work partially. It would not be the complete answer to controlling the disease in cattle. It would probably contribute about 40% of the control and the other would have to rest with the cattle. David King is correct in saying that if you do not deal with

the badger problem there will always be a residue of infection in cattle, that is absolutely true”, so there is an area of agreement and I hope we can put that to one side. Where is the area of disagreement? I think if anything it comes round to the issue of how big an area you have to manage and over what period of time so as to get all of the positive effects associated with the badger cull. The negative effects are all in the periphery, are around the areas, so the larger the areas, the more hard boundaries you put on those areas—it is very clear from the data, and if I can just refer to page 105, figure 5.4 in the Bourne report, you will see that it is all shown very clearly there. By the time you get to 300 square kilometres with 95% confidence they are saying the cull would have a significant effect on reducing TB in cattle. Now the issue is one of practicality: is it possible to achieve these large areas? Is it possible to use hard boundaries? You will see if you read our report that we do not address those issues. These are issues that can be addressed by officials, so if the practical issues actually mean that this cannot be implemented, and if the economics are such that it goes against the report, then this would not disagree with what we are saying. Essentially we are saying—and I repeat this—that this is a massive problem in the farming community and it is a problem that is spreading over a relatively short timescale, and so it is time for hard decisions to be made. I am very keen to see that good attempts are made to look at these practical issues and that is what I am pressing for in this report.

Q390 Chairman: As the Government’s Chief Scientific Adviser you know that there are many scientific challenges which Government has to address. Do you monitor these areas of, if you like, science care planning? Were you as an individual watching, before the Secretary of State picked up his telephone to speak to you, what was happening in this area, before David Miliband said, “Produce this report”? Was it something that was on your radar?

Sir David King: Yes, but in the sense that I have an office with about 90 people in it, a group of whom in my science in government team continually monitor issues of this kind, so the answer is, absolutely. The next question, if I may suggest it, is: and how do I prioritise how we spend our time in looking at data? Certainly, if a member of the Cabinet asked me to look at something that would be given priority.

Q391 Chairman: Given that this was on your radar, had you indicated to any official in Defra before the Secretary of State rang you that this was something that was on your radar but something that you felt you would like to have a go at?

Sir David King: I would be surprised if my officials had not done that, but for me to have a go at it, I think that would really require the Secretary of State to ask me to do that. In other words, I do not think I would have stepped in, but on the other hand I was hardly surprised.

Q392 Chairman: You did not get a call from the Treasury saying, “We are spending £90 million a year. What can you suggest we do about it?”

Sir David King: I did not actually get that call, but again I would not have been surprised if I had got it.

Q393 Lynne Jones: If I could go back to my original question, you say that you do not disagree with the data, although you do question their statistical significance, and you do rubbish their ability to draw conclusions from their own data. In your paragraph 41 you say, “The data do not support such an unqualified conclusion”, and in paragraph 42 you say, “The ISG view is unsound”, so you have rubbished their view and I cannot understand why therefore you did not avail yourself of the opportunity of discussing it with them.

Sir David King: We had the opportunity of the very detailed analysis they had presented and I would be very happy to send round copies of figure 5.4, page 105, of their report, which is the absolute basis of the comment I have just made.

Q394 Lynne Jones: Sir John Krebs described the report as not providing any wriggle room in terms of their conclusions, so there are other people who have looked at it in a different light. I still do not understand why you did not talk with the ISG as part of your challenge function, such as the example that you gave to us at the very start when you challenged those scientists to go and look at the data.

Sir David King: What I had in the case of the scrapie in sheep was a very different situation. I had for the first time, after a lengthy period of time, an unpublished report coming from that group of scientists and that was the reason I called them in. It would have been very improper of me to make a decision without calling them in. What I wanted to do was examine how robust their experimentation process had been and that is when I discovered that no DNA test had been conducted.

Q395 Lynne Jones: I would have thought it would be even more the case that you would discuss it with these scientists who had had all their work and their conclusions peer reviewed. Anyway, we will move on.

Sir David King: Chairman, I do think a bit much has been made about our statistical analysis and differences of opinion. We have had the various paragraphs being quoted at us. Our statement in paragraph 24, “This figure is on the borderline of statistical significance”, is simply a statement from the report itself. We have used the error bars in our analysis given in the report itself, so we have not gone beyond the report; we have taken data directly from the report and simply used it in our report.

Q396 Lynne Jones: But you have contradicted their conclusion. You have come to a diametrically opposite conclusion in terms of the practicalities of culling. If you were to have said, “Perhaps we ought at this time to try and address whether it is practical to have large area culling, certainly well above 100 square kilometres”, which is certainly not a large area, “and a sustained programme over 10 years”,

there might have been something to discuss, but you have rubbished their conclusion and suggested 100 square kilometres.

Sir David King: I cannot agree that their first conclusion follows from their data if you are simply taking a scientific view, absolutely. I am going to stand by that.

Q397 Lynne Jones: You say their data does not support their conclusion and yet you did not take the trouble to discuss why it was that they had a different view from yourself.

Sir David King: Because, shall I repeat, based on the scientific analysis there was no argument. We were simply saying that scientific analysis, based on the science alone. What they do mention are economics and practicality. When it comes to the science I am not, I repeat not, disagreeing with them, but their conclusion is not based on figure 5.4A on page 105 of their report and the other data.

Q398 Chairman: Just to pick up on a point of Lynne's analysis, in Annex 1, "Confidence Intervals", you provide a commentary on the confidence intervals which the ISG have used and then you say at the end, "I consider that this level of precision may give the impression of more certainty than is the case".

Sir David King: Yes. This is me speaking as a scientist, Chairman. I have always said to my students, "If you come to a figure of 34.7 and the error bar is plus or minus 15 then putting the decimal point, 34.7, is incorrect; it is misleading". That was just my statement. Statistics drop the decimal point; it is 35 plus or minus 15 in that case, so if you like that was just me making my own statement.

Q399 Chairman: But you are writing this document to an outside world that deals with language.

Sir David King: Yes.

Chairman: And there is another group of people who deal with statistics and scientific findings, and it is like all propositions: people look at them from different standpoints and come to different conclusions according to the way that they are presented and expressed; hence the line of questioning that we are following up.

Q400 Lynne Jones: In the two paragraphs you mention the mathematical modelling of the existing data. You heard the response earlier to that. Are you recommending that such mathematical modelling is done and, if so, should that not have been done before you came to your conclusion?

Professor Woolhouse: In answer to the second point first, I agree that this would be a challenging job. It is not something you could do quickly. I would not want to give an immediate estimate on how long it would take but it would need a significant research body to do that. I am slightly surprised that Christl was so negative about the prospects of undertaking mathematical modelling in this area. I would have thought it was a very natural candidate, given the amount of data that we have to undertake this sort of exercise. To follow up the point, I would be very

happy personally to take that up with Christl and have a discussion face to face with her to see why she thinks that. It seems to me that this is a natural candidate for mathematical modelling.

Q401 Lynne Jones: But you are advising Government. Surely, if there is further information to be obtained from existing data you should be obtaining that information before coming to a conclusion.

Professor Woolhouse: The paragraphs state that we think that mathematical modelling would be useful in extrapolating from the findings of the report. That comment was also made in the Charles Godfray report in 2004 and I would stand by it.

Q402 Chairman: I am going to be very rude and interrupt because it is 32 minutes past the hour and, Sir David, I am aware that we did give you an assurance that you could go. However, that does not mean you have to take up the assurance. We would love you to stay if you have any flexibility in your timetable, but I do not want you to put you in an embarrassing position.

Sir David King: I can stay for another five minutes.

Chairman: I would like to move on then, because we can come back and ask Professor Woolhouse some of these more detailed questions, Lynne. David, you wanted to ask a question.

Q403 David Taylor: Lynne has already covered it, but I have another question. How can it possibly be the case that a small team of no doubt very eminent scientists over a working day and a working breakfast on the following day can come to one or two distinctly different conclusions from data that have been assembled, analysed and examined and peer reviewed over a decade? To me that sounds a little bit like scientific arrogance.

Sir David King: The answer to your question can only be given in much more specific terms. In other words, if there are specific details of our report that you feel were too hastily arrived at then I can give you an answer, but the quality of our report depends very much on whether or not it stands up to critical examination, and that critical examination in my view is rather like the previous comment: it does not include the statement that these people are not "expert" enough because the judgment should be made on content.

Professor Woolhouse: I think there is a small issue of procedure here. As a working scientist I and my colleagues sitting behind me are regularly asked to make an assessment of a very large and long term study, possibly covered by many people, whenever we are reviewing a paper for a major publication or journal. This is quite routine, so I am less concerned about it than you, and I certainly reject the idea of scientific arrogance. That was not the case around the table when this was discussed at all.

Q404 David Taylor: To be able to turn round a significant conclusion of the report in what would appear to be a cavalier and unsustainable fashion is something that you really ought to respond to.

Sir David King: I simply cannot see how the words “cavalier” and “unsustainable” can be used after the debate that we have just had. It is very clear that the scientists basically agree that up to 40% of herd breakdown with TB is associated with the presence of badgers in setts on the land where those cattle are. That is an essential piece of information we all agree on. That is a valuable piece of information derived from this report, and if that is the basis of the science and if I stay within the domain of science advice then I do not think we are stepping outside any area of propriety or proper action.

Q405 Mr Drew: Bearing down on bovine TB is going to largely depend on the practicalities. We can have all these scientific arguments but somebody has absolutely got to go out there and do a massive cull of badgers. You have come to this with the best will in the world using somebody else’s data, working at a secondary level, and in a sense you are trying to interpret somebody else’s primary scientific findings. Part of the problem with this is that the evidence is very confusing. There is not a conclusive set of explanations that you can really state in evidence.

Sir David King: Could I just ask you, if you do not mind, Chairman, which piece of evidence are we talking about that is very confusing? Are you questioning whether badgers are a source of infectivity for cattle?

Q406 Mr Drew: No. What I am questioning is why you come to a very different set of conclusions from the ISG.

Sir David King: I still do not know whether that was an appropriate way to describe the situation if we are all agreed on that.

Q407 Mr Drew: Let me phrase this another way then. In terms of how this could work in practice, according to your approach to this you are taking the 300 square kilometres as being a realistic area to which you would want to cull badgers. Give me some idea of the percentage of badgers that you would need to cull to begin to make a significant difference to the level of bovine TB in cattle.

Sir David King: The answer to that from the ISG report is that around 70 to 80% does bring the down the incidence of bovine TB significantly, so already, if I can give this in epidemiological terms, what we want to do is bring down the reproduction factor below one. It does not have to be brought down an awful lot but we certainly need to bring it down and this is one of the factors that would do it, so I would say 70 to 80% reduction.

Q408 Chairman: Is that in all the red areas on the map?

Sir David King: That would be in the areas where there is high cattle TB incidence and those are not all the red areas. Those sporadic spots that are not in the large growth area I would not count.

Q409 Chairman: And that would mean all badgers over a period of four years?

Sir David King: Seventy to 80%. I was asked what population change of badgers would I perceive was right, and I am saying a reduction by 70 to 80%.

Q410 Mr Drew: What happens where you get landowner resistance? Is this commensurate with the Bern Convention, for example? There could be huge legal cases on the ability to carry this out.

Sir David King: You are wandering outside the science report but I am very happy to answer.

Q411 Mr Drew: I know it is outside the science but unfortunately the science of this particular disease is highly controversial and very unclear in terms of what could result from such an intervention, so I am looking at the practicalities that you will have to meet in order to deliver the scientific rationale.

Sir David King: You have asked me two questions. First, in terms of farmer acceptance of action—

Q412 Mr Drew: No; landowner, not the same thing at all.

Sir David King: In terms of landowner acceptance of action, the trials demonstrated that there was sufficient acceptance for the trials to proceed with satisfactory results within those culled areas. Reduction of cattle TB over the area was clearly demonstrated. Your second question was—

Q413 Mr Drew: The Bern Convention.

Sir David King: If you read my report right at the beginning, we say we are very clear about the Bern Convention and a 70 to 80% cull in our view would be within the terms of the Bern Convention. The Bern Convention states that you cannot completely remove wildlife from its native area.

Q414 Chairman: Can we stretch your five minutes? I have got one 30-second question. You have looked at culling and you have come to some conclusions. Do you think it would be a good idea if you applied your scientific rigour to the field of vaccines to address some of the problems that came out of the evidence that we took on that, not this never-ending hope that we get there but the question of how do we get there quicker?

Sir David King: I took evidence from exactly the same vaccine expert as you took evidence from and we refer to that in our report.

Q415 Chairman: You refer to it, but, in terms of providing advice as to what could be done to fast-forward the process, is that something that you might now like to do some further work on?

Sir David King: Absolutely. I think vaccines are very important in this area, and so it is very useful that you have asked this question and I am happy to answer it. The work on vaccines is progressing. You have heard about that. It will not be available in terms of badger vaccines which are injectable for at least two years in a practical form, but oral vaccines are going to be absolutely crucial in terms of implementation and it is a good few years beyond that before we are going to see them. Of course we want to see more research in that area and we point

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out that this cull procedure that we are suggesting could be terminated as soon as an effective vaccination procedure was available.

Chairman: We must let you go but there may be some other questions about methodology which I might ask Professor Woolhouse if he would kindly field.

Q416 Lynne Jones: In terms of the 70 to 80%, the evidence we have got from the NFU is that they say that partial control is likely to be worse than no control at all and the key to a successful cull is to achieve as close as possible 100%, so you would disagree with the conclusion of the NFU in that sense?

Professor Woolhouse: I have not seen that NFU report myself. What I would infer from that is that they were commenting on the edge effects which are possibly explained by the perturbation hypothesis, and that was an effect that was nicely documented and analysed in the ISG report. I am inferring that that is what they refer to.

Q417 Mr Williams: In coming to your conclusions did you look at the effectiveness of restriction of cattle movements, the pre-movement testing?

Professor Woolhouse: The remit our group was given was to consider the role of badgers in the transmission of the disease. In other guises, of course, we are very interested in that, and in terms of some of the geographical spread of bovine TB in the last few years clearly cattle movements are extremely important. My understanding is that the general feeling is not that they are responsible for maintaining, or at least increasing, the levels of infection in the hotspots alone.

Q418 Mr Williams: But I think your report concludes that badger removal should go along with restrictions and control of cattle movements.

Professor Woolhouse: Yes, and that again would agree with the conclusions of the ISG, that, although badger control or prevention could have a role to play, alone it is unlikely to be enough to completely solve the bovine TB problem in cattle.

Q419 Mr Williams: Is there any further research on the effectiveness of control of cattle movements to establish what contribution that plays in eliminating it?

Professor Woolhouse: Again, as a scientist you would expect me to ask for further research. At a more practical level I think Defra should certainly be keeping under review the effects of the movement and testing regimes, the diagnostic tools they are using and so on, in order to make sure that we are controlling any spread from cattle movements as effectively as we possibly can, given any advances in research knowledge or technology. That is clear.

Q420 Mr Drew: In terms of the pure practicalities of this, what evidence did you take separately from those who would be tasked to carry out badger removal operations? In particular, what means

would need to be applied to achieve even a 70 to 80% level of removal, and did that play any part at all in your conclusions?

Professor Woolhouse: I am beginning to feel very exposed if you are going to ask me about the procedures under which the Chief Scientific Adviser does his operation.

Chairman: Do not go beyond what you feel comfortable in answering.

Q421 Mr Drew: You can just say that you are unhappy with that, but it is an important question that we try and wrestle with, and this goes back to my earlier point about—

Professor Woolhouse: In terms of the input on the practicalities, we did have present in the meeting for background information the Chief Scientific Adviser for Defra, Sir Howard Dalton, and the Chief Veterinary Officer, Debbie Reynolds, and a number of their colleagues, and they were helpful in commenting on that as a practicality and so on, but that is not within the remit of the scientific group that Sir David assembled.

Q422 Chairman: Just on one practical point in your report, you comment that the badger population should be “monitored”. Did you come to any conclusions as to who should do it and with what frequency? Was it going to be UK-wide monitoring, England, Wales, what? What conclusion did you draw on that?

Professor Woolhouse: Again, I am not specifically a badger expert, and Rosie Woodroffe can no doubt address this more clearly for you, but there are attempts to survey the population density of badgers from time to time in the UK. The feeling was that if you are going to implement—and it is beyond my remit to say whether you should or not—any kind of badger control you need to be very clear about what you have actually achieved on the ground, for two reasons. One is to understand why you have succeeded, but the second, if things do go wrong, is to understand why you failed, and that is a very important part of trying to assess the performance of any kind of large-scale intervention. That would apply in a lot of different circumstances from controlling TB in badgers. You need to understand what is going on.

Q423 David Taylor: You say you are reluctant to comment on practical methods of carrying out culling and so on. Do you recall any of the discussion that took place with the Defra people and others there about what would be the most humane and effective means of removing badgers? Do you know what they meant by that or was that referred to in regard to snaring perhaps?

Professor Woolhouse: Snaring was discussed because, of course, that was one of the methods used in the Irish trials, and my understanding is that that is not felt to be humane and sustainable on a large scale in the UK. You really do need to talk to some animal welfare experts.

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Q424 David Taylor: Do you recall which ones were broadly left as viable options?

Professor Woolhouse: The one that has already been rejected, as you well know, is gassing, which was rejected some time ago, so we are left with trapping and shooting as the alternatives, as I understand it, but you really need to talk to someone who is expert in these areas.

Q425 Chairman: Can I just take you back—and I am sorry this is a little bit random but there were a lot of points that came out of your report—to paragraph 46 where you say the following: “This time lag does not seem to have been taken into account when the ISG collected data on cattle TB incidence immediately after the first proactive cull”? You said at the opening of your remarks that you basically came at this subject from the same data as the ISG, implying the analysis was okay, and yet in this particular paragraph you do seem to be hitting them head on about the measurement of the effect in the first year of culling. You say you cannot really read anything until you have done it for two years. That does seem to me to be a challenge in methodology as a layman reading those words. Why did you choose, if you like, to come to that particular conclusion, because obviously it questions the analysis of the effectiveness of culling, does it not?

Professor Woolhouse: It certainly does not challenge the data or the analysis of the data that they received. It is a question of how much weight you place on the first year’s results in an intervention of this kind. There are a number of studies that have shown quite clearly that these sorts of interventions are going to take a number of years before they have their full effects and the Irish trial is a very good example of that. Not only does it take in that case four or five years in order to achieve the full effect they saw at the end of that trial, but, if you like, the way to that final effect is quite noisy. Even in the Irish trial in some years in some sites the incidence of bovine TB in cattle went up as it was going down. These are very stochastic processes. There is a lot of variation in the trajectory, so it is difficult to draw firm conclusions from just one year’s data, and that, of course, was one of the difficulties that was highlighted by everyone.

Chairman: I deliberately picked that because you have made a statement that says it is very difficult to draw conclusions from one year’s data, but if I understood the ISG’s work correctly (and they can answer) they did put quite a lot of weight on what happened in year one. I suppose one of the factors that we are trying to sieve out is how much you are having a go at the way they interpreted the information, and there does appear to be a difference

of opinion about the year one effect, as you have just enunciated. They take a different view. The difficulty for the lay person is whose view is right and how do we decide whose view is right, because it is effectively lay people with the benefit of advice who are going to have to ultimately take the decisions as to what is going to happen to deal with the disease pool which Sir David King, quite rightly, identified as a major problem that had to be dealt with. I am going to leave that as a statement because you may not be able to help us adjudicate and Mr Drew wanted to come in with a further point.

Q426 Mr Drew: Did you actually read any of the papers around the Thornbury experiment, which obviously was the most comprehensive study of badger removal over a long period of time, even though most of those papers have been destroyed? Do you know about Thornbury?

Professor Woolhouse: I know of Thornbury. If you are going to start quoting it at me I am going to have to—

Q427 Mr Drew: It would be interesting to know about that, because if you were coming to that conclusion you would have to look in a sense at what the existing history of culling was in this country, and Thornbury is as close as you can get to some scientific investigation, so did that play any part at all in you coming to the conclusion that you came to?

Professor Woolhouse: It is not cited in the report, I believe.

Q428 Mr Drew: No, it is not cited.

Professor Woolhouse: Although the experts around the table would have been aware of it to some degree, I would not say it was a major contributor. The major contributor, as Sir David has said repeatedly, was the ISG’s report and the publications arising from that.

Chairman: Thank you very much for staying on and answering those additional questions. You are very welcome to stay in whatever capacity you like and listen to the next bit because we did say at the outset that there were some more questions that we wanted to put to John Bourne and his colleagues, but we also wanted to afford them the opportunity of providing us with a commentary if they wanted to. They do not have to if they do not want to but the opportunity now exists for him and his colleagues to say a few words about what they have heard from Sir David King. It might help us as lay people to understand what it is that we have been told, so, Professor Woolhouse, you can either move to the end or go to the back, whichever you feel comfortable with, and we will invite the ISG former members to resume the witness stand.

Letter dated 29 October 2007, from Sir David King, Chief Scientific Adviser to HM Government and Head of the Government Office for Science

BADGERS AND TB IN CATTLE

Thank you for giving me the opportunity yesterday to talk to the EFRA Select Committee about my report on badgers and TB in cattle.

My office contacted John Bourne on Thursday and repeated my offer of a meeting to discuss those areas of difference between our two reports. However, as was apparent at the session, I think we are broadly in agreement on the interpretation of the scientific evidence.

During the session, you asked me when David Miliband had asked me to carry out my assessment and I replied that I thought that it was in the week following the publication of the ISG's final report (on 18 June 2007). However, I have now checked the sequence of events and find that, although detailed discussions about the issues to be covered took place in that week, initial discussions had begun earlier. On 31 May, David Miliband noted that following the ISG's final report, it would be important to have an assessment from me of any scientific issues relating to the role that badger culling could play in controlling and reducing levels of cattle TB in England. On 11 June I confirmed that, once the ISG report was received, I would carry out a short assessment of the key scientific issues in this area. Formal terms of reference were not established although discussions about the broad scope began on 4 June.

Witnesses: **Professor John Bourne CBE**, former Chairman, **Professor Christl Donnelly**, former Deputy Chairman, and **Professor Rosie Woodroffe**, former Member, Independent Scientific Group on Cattle TB, gave further evidence.

Q429 Chairman: I do not know who wants to start but it might be quite interesting to take the views of the former ISG members about what has been said. This may not be peer review in the accepted sense but it is the best that we can manage.

Professor Bourne: Would it be helpful if I put some structure onto what has gone before because I can understand why you are confused?

Q430 Chairman: Yes. Structure is always helpful.

Professor Bourne: First of all let me make the point that the comment was made that we did an experiment. That is not true. What we did was carry out a trial of future policy options, one of which was reactive culling, the other was proactive culling, with an expectancy at the time that these would be rolled into the field. Government subsequently determined that this was not going to happen. They eliminated the Wildlife Unit and if there was going to be any culling in future farmers had to do it. However, this was not just an experiment. The whole trial was designed by us to provide a range of epidemiological evidence and, my goodness, it is a good job we did it that way because that epidemiological evidence is so critically important. That is point number one. Point number two is that it is suggested that the evidence is confusing. I do not think it is confusing at all. I think we have shown very clearly that localised culling makes the situation worse and we provide the very plausible hypothesis why that happens, namely, perturbation, but since reactive culling has finished the negative effect of reactive culling has gone. I think that is quite an interesting observation. If you stop culling, stop perturbation; the negative effect of reactive culling goes. We have shown that reactive culling as carried out makes the situation worse, and we associate that with greater perturbation, but all the issues around that lead to an increased incidence in cattle and we are suggesting there is a link between the two. With proactive culling, which in our hands

led to something like an 80% culling efficiency which resulted at the end of the day in something like 70 to 75% removal of badgers, and a large proportion of those that were left came in from the outside; they were immigrant badgers, we did find overall in 100 square kilometres, the area mentioned in the King report, something like a 23% reduction. There is no question that badgers contribute to cattle TB. In the very centre of the area it was higher than that. The modelling suggested overall that the impact badgers were making on the cattle TB problem in the areas in which we were working was about 30%, 30%, 40%, it was about that. The rest was down to cattle. We put forward ways in which we believed the cattle element could be tackled, and Sir David has accepted all of that; not in his report but certainly in media reports he accepted all of that. The issue comes down to how do you deal with the badger component. There is no doubt that culling has an impact. The problem is that although you have a positive impact in culled areas it is this perturbation issue that creates a problem. This, I think, is where it would be useful to spend a few moments discussing this. I am aware that in addition to the King report Defra sought in-house reports from the Central Science Laboratory (CSL), the Central Veterinary Laboratory (CVL) and Natural England. I have not seen these but I know they were commissioned, and within Natural England and CSL there are high-class ecologists, but I am sure you would find these reports of value too. I suggest you ask for these and study them; they do provide you with further information which I believe could be helpful to you. What we have shown is that perturbation is an issue. I am bound to say that when we started this work I certainly did not believe that perturbation was a problem. We knew about it but I did not think it would be an issue, but the data we have suggest it is an issue. In the King report I think they have underplayed perturbation. I will ask Rosie to talk about this in a moment. It would appear that

they have not read all the literature. There are a number of papers that have been published on this which they do not appear to have read and I think they are overestimating the impact of geographical boundaries. They are making a number of statements on the value of one kilometre of arable land, for which there is absolutely no data whatsoever, and they are really saying, "There is a problem there but we can overcome it in some way by believing that we can". With respect to the size of the areas, we did extrapolate to 300 square kilometres or more. Sir David said we found significant impact of badger culling by that extrapolation. That is not true. We reported a modest difference between the positivity and the negativity. We then questioned the economics of the thing. You asked me earlier about comments that Lord Rooker had made and I think he criticised us with respect to the economic analysis. If you look at our first report, when it was suggested that a cost analysis be done, it was Lord Rooker who asked us to put an economist on the committee, so it was quite clear that we were going to provide some economic information, which we did. We did not do a cost benefit analysis; there were no benefits, and it is fully explained in the report. The other thing we found was that if one were to get the same effect that we did culling had to be done over the piece simultaneously, it had to be done in a co-ordinated manner and it had to be carried out for a very long period of time. In other words, it was not a trivial thing to do. We discussed this at length with respect to licensed culling that Defra firmly put on the agenda in our final report, and our advice was that it was totally inappropriate to expect farmers to do this. It could only be done using expert fieldsmen who would require an immense organisation and logistical activity to do it. Perhaps Rosie could pick it up from there and discuss the perturbation issue.

Professor Woodroffe: Certainly.

Q431 Chairman: Just before you do, and I am sorry if this is going to be a little bit tedious but it is very central to the question of this perturbation effect, going back to what Sir David's report said, in paragraph 27 it says, "The results are hard to interpret but it would appear that there is some evidence for an increase in cattle TB outside the removal area". They then go on to discuss the two-kilometre zone and its statistical impact, and they then say, "The increase was not statistically significant", so that is an interpretive point on the data that you had, which I would be grateful for your comment on. They then go on to make a third point, that there was an apparent small beneficial effect in the area up to half a kilometre from the removal area, so they are saying that things get better just across the boundary, which is an interesting observation. Then later on, after some more commentary, they say that perhaps perturbation—and I hope I have not misunderstood paragraph 31—"indicates that the detrimental effect seen outside the removal area may well be transient". In other words, you saw something

happening but it goes away after a while. I guess that must refer to their subsequent observations about the comings and goings of badgers, but then they say in paragraph 37, "However, there is a reasonable possibility that the disruption is transient. The data do not discount this theory. If the disruption is transient the single regression model for the effect of perturbation used by the ISG is not adequate", so that is, if you like, an attack on your methodology. Perhaps you could, bearing in mind we are not statisticians and not experts, help us to address that critique of your information.

Professor Woodroffe: I think you have absolutely put your finger on a very important point. Whilst Sir David King and Professor Woolhouse have repeatedly reiterated that they think there is almost no disagreement between the ISG and themselves, you have put your finger on the key area of disagreement, and I think that the reason you were seeing shaking heads behind them is that this particular issue of detrimental effects which they considered unconvincing and hard to interpret we considered very strong. Perhaps Professor Donnelly would be best placed to address the statistical issues and then I can come back to the ecological issues.

Professor Donnelly: As a statistician I feel I should declare one interest, which is that I am going to use "significant" in its statistical sense, which is that if it is a significant effect the 95% confidence interval does not include zero. I think that is a bit different from the way John was just referring to it when he was saying, "David King said it was significant, I say it is modest".

Q432 Chairman: You talk about margins for errors. We watch opinion polls. Those are the crude numbers we understand.

Professor Donnelly: There are a few things that are going on. One is this issue of between culls one and two, and so let us address that first, and then we need to talk about what we are using to test the detrimental effect. Between culls one and two the breakdowns that will be detected will include breakdowns that resulted from infection events that happened before the first cull and infection events that happened between those two culls, because testing was every year and so it includes over that one-year time period. Keep in mind that we are always comparing like with like in terms of proactive areas with survey-only areas, and so we are comparing those same time periods. What will happen is that in that first year there will be a bias in the estimate towards no effect because some of what we are observing will be from the no effect period before any culling took place. Therefore, rather than there being any invalid period when we might get something spurious, we are actually getting an estimate that is biased towards the null because some of the differences will not be detected until the period between the second and third culls.

Professor Woodroffe: So it is conservative.

Professor Donnelly: Yes. We did not place any more emphasis on that particular usually year period than any other year period, but we considered them all in

sequence. When we did that we found a non-significant trend towards a decreasing detrimental effect outside. We did address that. We discussed it both in the report and also in the IJID paper which David King cited. However, one of the things that we want to consider is that when doing sub-group analyses you have less precision, and I draw people's attention, if you have the final report, to page 99, which shows estimates stratified by which culls they were between, and I have the IJID paper which has the same graph as figure 2 right in the middle, so I will distribute it. It is either page 99 of the final ISG report or figure 2, which is right in the middle of the paper I am handing round. These figures show the variation in our estimated effects—

Q433 Mr Drew: Are you looking at table 2 or figure 2?

Professor Donnelly: Figure 2.

Q434 Chairman: Figure 2, page 304, top right hand corner.⁵ Just take us through the construction of the picture that we are going to see before you explain it to us because some of my colleagues—and this is not attacking their ability to understand—may not quite be keeping up, and the audience behind us are not where we are, so you will just have to bear with us whilst we have this explained to us, and if anybody does not understand perhaps they would indicate and ask as we go along. We will do our best to understand.

Professor Donnelly: The top figure shows divided-up estimates for inside the targeted culling area and outside the culling area, and so the estimates are divided up in the top figure by cull sequence between culls one and two, two and three, three and four and so on; four and more get lumped together. What you see is that consistently in all four of these time periods outside trial areas in this two-kilometre zone there is a negative effect of culling which is detrimental above the line, and below the line it is a beneficial effect of culling. The beneficial effect of culling appears, based on the point estimates, to be greater after more culls. I wanted to point this out because there was this point that a simple regression is not an adequate way of looking at this. We very specifically presented this data so that people could see exactly what the estimates were. A regression will assume, say, that there is a linear effect, so you can put a straight line through. Here we are not assuming that. There is a “connect-the-dots” between them so that you can connect them up, but there is no assumption of linearity there; it is purely the data, so you can see wobbles and variations cull to cull. In each of these there is a non-significant but general trend towards a decreasing detrimental effect with more culls outside and increasing benefits, so both things move towards a better situation after more culls.

Q435 Mr Gray: So what you are saying is, the more badgers you kill the less TB there is?

Professor Donnelly: After you have culled for a longer time.

Mr Gray: All this thing goes all the way across this and I cannot understand what you are talking about.

Chairman: Do not attack the messenger. She is doing her best to explain it in her language to us as lay people.

Mr Gray: I do not think so.

Chairman: You have drawn a conclusion now, so you want to test out whether you have got the right message.

Q436 Mr Gray: I am trying to understand what she is saying. Would you mind expressing it in language that a thick fellow like me can understand? I am sorry about that.

Professor Donnelly: More annual culls, better results.

Chairman: Now you have got it. He is in line for a degree already.

Q437 Lynne Jones: You said non-significant.

Professor Donnelly: I was talking about the point estimates. We looked at what the net effects were, and, balancing these two different areas out, pluses and minuses, the net effect between the first and second culls is consistently detrimental overall, looking at those two counteracting forces, but in all the ways that we looked at it with different sorts of linear effects in different databases we get a net beneficial effect after four culls. That still means that that is a net beneficial effect judged over the whole area, and of course that still involves some areas experiencing a detrimental effect and some areas experience a beneficial effect. The next thing I want to point out is on the graph below that, where this is all time periods taken together but we have now subdivided by how far from the boundary, and this is probably more difficult to see. Think of the line that goes vertically in the middle of the graph as the boundary between the targeted area for culling and the untargeted area. As you move to the right you are getting deeper and deeper into a trial area and you will see that the estimates move towards a more beneficial effect. That was a non-significant trend but you do see quite a lot of consistency there. That is where David King was quoting about 40% benefit by the time you get deeply inside these trial areas. Outside the area targeted for culling there are four estimates dividing up the zone up to two kilometres out. You see an estimate of beneficial and then three detrimental effects. In that first zone between nought to 0.5 kilometres outside the culling area some of that area was actually culled, and the reason for that was that the trial area boundaries were drawn up and then after that areas were targeted for culling based on Rosie looking at maps and approving boundaries so that whole social group territories were targeted, and Rosie can talk about why that is. Some of that area between nought to 0.5 actually

⁵ Donnelly, C *et al* (2007). “Impacts of widespread badger culling on cattle tuberculosis: concluding analyses from a large-scale field trial”, *International Journal of Infectious Diseases*, Volume 11, Issue 4, July 2007, p 300–308.

received culling and it is quite plausible that that is why there was a beneficial effect there, but beyond that you see three detrimental effects.

Q438 Chairman: Whoa, whoa. In the report which Sir David King did he talked about, if you like, doing some work in the margin, in the area which would be the perturbed area. Is that what you are effectively saying you subsequently did, which was to go back and when you have got the extent of the social groups of the badgers do a bit more culling but outside the boundary?

Professor Donnelly: It was not going back. It was done from the outset.

Professor Woodroffe: What we did was, we started out with trial areas which we defined on the basis of property boundaries. The entire area plus land up to two kilometres—usually not as far as two kilometres but a maximum of two kilometres—outside was then surveyed for badgers. For all of the areas before they were allocated to treatments they were surveyed in that way, and then we went and inferred from the field data where we thought the boundaries of the social group territories fell, and we did that because we were concerned about perturbation and we thought we could minimise perturbation by trying to remove complete social groups, so we wanted to make sure that every property that fell inside the trial area was going to get the full culling treatment. We did not want incomplete culling on the outer area occurring because perhaps the main setts of the badgers that lived on this farm were just outside.

Q439 Chairman: So basically you refined the cull areas to be as complete as possible in terms of the social areas for the badger setts you had identified, and therefore in any commentary which subsequently comes about, if you like, the statistics of perturbation take that refinement of the boundaries into account?

Professor Woodroffe: Yes. The culling areas were slightly bigger than the trial areas and that is made very clear in all sections of the report. That is probably why you see that potentially beneficial effect just outside the trial area boundary, because a lot of those farms were receiving culling even though they were not inside the trial area.

Professor Donnelly: Could I make one more comment to discuss these graphs? The boundary you see on each one of these points, to give you an indication of uncertainty, are 95% confidence intervals, but we had a concern in terms of the interpretation of these 95% confidence intervals in the David King report looking and saying, “Okay, outside trial areas three of the four include zero; therefore this does not look like such a secure result”. If you look on the right hand side, all five of those include zero and that does not mean that the beneficial effect inside is insecure. Those confidence intervals are in a sense your level of uncertainty if you are just looking at one of these points. What we were doing here was showing how well each one of those points was estimated individually to justify where we thought we could get benefit by fitting a

linear regression, and that is what we did for the cull number effect for the figure above. For the figure below we fit a linear effect looking at distance from the border inside trial areas. Outside trial areas there was no evidence, looking at this, of any linear trend.

Q440 Chairman: The message I am getting from that is that you adjudge, as somebody who is a real expert on the statistical modelling in the context of this work, that you had a very sound methodology and that you firmly rebut the line of criticism which Sir David King has identified.

Professor Donnelly: In terms of the unsoundness or weakness in the external effect, yes.

Q441 Chairman: Would you agree, just looking at it as a layman, that it is possible for somebody looking at your data to draw the kind of alternative conclusions which Sir David King has done, because the thing that I struggle with in this is that we are not dealing with absolutes. There is not, for example, an absolute measure of temperature that there is in certain scientific experiments. What you are dealing with is your interpretation of some field data, so is it unfair for anybody to come to a different conclusion than you did?

Professor Donnelly: I think it is unfair for them to come to a different conclusion on the basis of counting how many of these confidence intervals include zero. There are always going to be uncertainties in terms of epidemiology. When you find an increased heart attack risk associated with some risk you cannot identify usually which individuals had the extra heart attacks and it is similar here in that you cannot identify which of the herd breakdowns are the extra ones that would have become breakdowns had we not done culling or got the extra breakdowns, so there is that difficulty. However, the consistency between the strength of the statistical results is then strengthened considerably by the analysis of ecological data, which is what I think Rosie can speak to more clearly.

Chairman: I just want to stop you there because there are going to be limits to what I and my colleagues can absorb for this and I want to give them a chance.

Q442 Mr Williams: The article in one of the veterinary academic journals by some Irish authors, I think, was critical of your report on the basis that the perturbation effects could not possibly have taken place in such a short time as you have indicated on the basis that the time the badgers take to move, the time that they need to infect other badgers and for those badgers to infect other cattle and for that infection to be evidenced in tests would have been a very long time and much longer than you claimed in your work. That was not something that was actually raised by the Government Chief Scientific Adviser.

Professor Woodroffe: We are in the process of responding to that paper and I am very happy that you have raised it. There are two separate issues here. One is saying, was there a detrimental effect, and I think that the statistical evidence that there was a detrimental effect is very strong. What they were

criticising in that case was our interpretation of the mechanism leading to that detrimental effect. We had proposed in brief that when you cull the badgers that disrupts their territorial organisation, they mix around with one another, range more widely, meet more cattle herds, and if they are infected they have got the opportunity to infect more cattle. The contention was that we could not possibly see such a rapid effect because that chain of events could not take place fast enough.

Q443 Mr Williams: Was that in *The Veterinary Record*?

Professor Woodroffe: That was in *The Veterinary Record*, precisely. This is an issue that has been raised in the past, and in fact when we published these detrimental effects around proactive culling areas in *Nature* in 2005 we addressed exactly this issue in the supplementary information. I sympathise with Sir David King and his committee at having to read our fat report, and also not just all of our scientific papers but also many pages of supplementary information that were provided, and perhaps the need to read such a large volume of information might explain some of the deficiencies that we have seen in their report. The series of events is, you cull the badgers. How quickly do they start ranging more widely? Essentially, in ecological terms, immediately; it happens within a few days. We know that. In fact, Professor Tim Roper was one of the advisers to Sir David King, he was the person that did that work, so we know very confidently that badgers ecologically respond rapidly. Then they are presumably contacting cattle and that is the sort of area where you are not quite sure how often they are contacting cattle but, after being exposed to *M. bovis*, evidence from experimental infections carried out, I believe, at the Institute for Animal Health suggests that responsiveness to the tuberculin test takes about three weeks to develop. Therefore, in theory, within a couple of months you should be able to detect an elevated number of infections, so we have contested very strongly, and are continuing to do that, the idea that these results are implausible. They are perfectly plausible based upon the evidence that is available to us.

Professor Bourne: We deal with this in the report. The suggestion is that taking experimental data from cattle with respect to the timing of development of a tuberculin reaction is not the thing to do; we should use field material. Well, of course, you cannot use field material because you do not know when these animals have been infected. I suppose the nearest we can come to this is an experiment that was done at CVL over the last 12 months when they took a group of tuberculin-positive cattle and housed these with sentinel cattle, and within seven months 50% of the sentinel cattle were infected.

Q444 Chairman: But I can equally quote you an example that we heard when we went to Devon last week of 29 infected calves within a closed herd being put in with other cattle and there was no cattle-to-cattle transmission.

Professor Bourne: I can also quote you a situation in Australia where infection in cattle took seven years to be detected by the tuberculin test. That probably tells me more about the tuberculin test than anything else. We can use only experimental data, and that is experimental data we have, which are consistent with this finding.

Q445 David Taylor: Professor Donnelly, I saw on page 99 of the report and the bottom half of the portrayed data that it says the distance from the trial area boundary is four to five kilometres in a 100 square kilometre area. In a 300 square kilometre area you cannot get much more than eight to nine kilometres, I would calculate, from that boundary. Is it an incorrect inference to think that that graph might extrapolate down slightly as you get further and further away from a boundary and that the beneficial effect would get significantly closer to 100%? It stops at 50% in that bottom graph, does it not, at the five-kilometre point?

Professor Donnelly: Yes, about that. If you are doing it linearly you have got a pretty good idea that you get ten in and then get 100%, which would not be plausible if we think that badgers are responsible for—

Q446 David Taylor: No, exactly.

Professor Donnelly:— less than 100%. While you could do that, as a statistician I would be extremely cautious about doing that. For one thing, the linear trend, even among the data that we have observed, is just on the borderline of significance, so it is not overwhelming even for the data that we have and then extrapolating. The difficulty is, of course, that that would be extrapolating a linear trend on that basis but what you really want to extrapolate is the ecology.

Q447 David Taylor: So how has David King come up with 300 square kilometres as the magic area?

Professor Donnelly: I think he is looking at the graphs that we did. We did two different scenarios.

Professor Bourne: This is the graph on page 105.

Professor Donnelly: You have the full report there. It shows two scenarios, the bottom of which assumes a constant benefit across the whole culled area, no matter how big it is, and then counters that with a detrimental effect outside. The one above, A, assumes that you have this trend with distance from the boundary, so the lower one is more conservative but the reality is that it is difficult to say beyond four to five kilometres, which is what we are able to observe.

Q448 Sir Peter Soulsby: I want to take you back to your very helpful explanation of the data and what it meant and take you particularly to what has already been mentioned as to what Sir David King said about perturbation. He said—let me see if I can get this right—that there is a reasonable possibility that the disruption is transient, and then he takes things on from there and develops that quite significantly.

Is he right? Is there a reasonable possibility from what you said to us and what your studies show that as a disruption the perturbation is merely transient?

Professor Donnelly: It is quite possible. I will read you the sentence of the results. Having looked at this detrimental effect outside, it looks, like a linear would be, quite reasonable; it wobbles around a bit but it has a general linear trend down. The linear trend suggested a 7.3% decrease in the detrimental proactive effect with each cull, but the P value for that is 0.17. Statisticians for significance produce 0.05, so it is a suggestion of the transients, but it is far from convincing in and of itself. That is when you would also look toward the other ecological data.

Professor Woodroffe: Yes. If I can just come in on that, it was quite frustrating, reading this report, where they say that the possibility that this effect was transient was something which the ISG ignored, when we had made repeated mention of it, and that paper that Professor Donnelly has just circulated actually had quite a detailed ecological explanation for why you might expect to see these effects diminish over time. I can go into the ecological explanation if you like but it is a little intricate. Suffice it to say that there are suggestions of reasons for thinking that you might see such a reduction over time, but, as Professor Donnelly says, it is not a statistically significant effect. One issue that I did want to raise is that later on in their report, buried somewhere deep inside, there is discussion of reopening the door on localised reactive culling. We have already discussed this issue of whether the first year is irrelevant or not. Sir David King's group admitted claiming that we could not really interpret anything from the first year of data, and that happens to be the year when you see these particularly severe detrimental effects, and ecologically that is exactly what you would expect. That is the period when you have caused the massive disruption in badger society. As Christl has argued, if anything, that might even be an underestimate of how severe the detrimental effects are because it has to some extent been diluted by what happened the year before, before you started culling. If you are going to do culling over many years, for example, over the first few years of the study—and Christl will correct me on the numbers—that initial detrimental effect is so severe that you get a statistically significant effect even over two, three, four years. It is only when you start going for much longer periods that it begins to make the overall effect non-significant. If you were, say, going to do 15 years of culling, you could begin to say, okay, this is a cost you have to pay early on, but when it is diluted over many years perhaps you can discount it or think it is going to get diluted. If you go back and think about something more like reactive culling, something more like licensed culling to individual farmers, which is likely to be small-scale and, critically, was always conducted as one-off culls, all you are ever having is the first year when you have these very severe effects, so it is very important to bear in mind that, even if you think there is an argument for discounting the first year when you consider

proactive culling, which I would contest, at least on the sorts of timescales we are talking about, it is absolutely critical for understanding what the effects of localised culling would be.

Q449 Chairman: If you put it the other way round that reinforces one of your principal findings, that if it is going to work at all it has got to be big.

Professor Woodroffe: Yes.

Q450 Chairman: Big and continuous.

Professor Woodroffe: Big and continuous. These detrimental effects in the first year are so severe that they overwhelm any of the benefits and the net impact is negative. That graph that you have seen is based upon assuming that you cull over five years. If you were to do the same thing for one or two years you would see an overwhelming detrimental effect more or less, almost however big an area you cull.

Professor Bourne: But there are other criteria for culling and one is that it should be done simultaneously.

Professor Woodroffe: Yes.

Q451 Mr Cox: It should be co-ordinated.

Professor Bourne: Yes, absolutely. Also, Sir David says here that the removal process must be effectively done by competent operators.

Chairman: I am going to draw matters to a conclusion. Two more colleagues have caught my eye.

Q452 Lynne Jones: My question was really to follow up on the same thing. Sir David King only says that there is a reasonable possibility that the disruption is transient and that the detrimental effect appeared to reduce. In a way, that is true, is it not?

Professor Woodroffe: Yes.

Q453 Lynne Jones: And he acknowledges that the reduction in the detrimental effect is not statistically significant, so I cannot see anything wrong with what he is saying there. What I think is wrong is then to take that particular statement and say that as a result of that culling is a reasonable strategy.

Professor Woodroffe: Absolutely. If I could just raise one issue that I think is very important and that I would like you all to think about, it is comparing what we have been saying with what Sir David King has been saying. In the report he says, and I quote early on in the report, I think at point four, "TB control will require interventions that reduce the prevalence of disease in both cattle and wildlife". That is what they are hoping to achieve, and certainly when Sir David King was sitting in this seat here and talking about this, he repeatedly talked about the need to eliminate TB and that unless you deal with the issue in badgers you are never going to eliminate TB. Unless you eradicate badgers you cannot eliminate TB in badgers by culling them. There is no current method. This paper, which was published in *Proceedings of the National Academy of Sciences of the United States of America* and which I will provide to you, is called *Culling and cattle*

24 October 2007 Professor John Bourne CBE, Professor Professor Christl Donnelly
and Professor Rosie Woodroffe

controls influence tuberculosis risk for badgers, and shows very clearly that culling increases the prevalence of disease in badgers, and it is very consistent and there is really very little debate about it. I think it is quite a fundamental misunderstanding that when you read this report you could come away with the idea that you can eliminate TB in the cattle/badger system by culling badgers. You cannot.

Professor Bourne: “Elimination” is not a word we have ever used.

Professor Woodroffe: Unless you eliminate badgers completely.

Professor Bourne: No. Defra eliminated the word from their vocabulary two years ago.

Q454 Chairman: But I do not think in either of the reports, whether you cull and on whatever basis, anybody has actually ever said you eliminate TB. In fairness to both sets of reports, that is not a conclusion you drew.

Professor Woodroffe: Sir David King used it just this afternoon, and if you check the transcript you will see.

Q455 Chairman: One has got to be fair on what he said because I read his report and that is not what he said.

Professor Woodroffe: He said it this afternoon.

Chairman: He may have said those words but that is not what is written in his report. The argument is about effectiveness within the scenarios of culling. I am pleased to see that the handout in this day and age of electronic education has not gone away. Your lectures must be full of people with bits of paper.

Q456 Mr Drew: The ISG work was heavily criticised throughout for not taking out sufficient numbers of badgers to really be able to feel that there was a robustness in the way in which you were trying—and I apologise if I used the word “experiment”—to carry out the particular study that you were carrying out, and we got that last week in our trip to Devon where there were lots of accusations that you did not take out enough badgers regularly enough to get a real purchase on what you were trying to achieve. Is trapping an effective enough way to get the sort of removal that the King report is alluding to, or have you got to consider other measures?

Professor Bourne: We were committed on welfare grounds to using cage traps, as you know, with the expectancy that we could achieve an 80% trapping efficiency, and that is consistent with the data we have, that we did trap around that percentage and we achieved something like 75% or a little less removal of badgers at the end of the day, taking into account badgers coming back into the piece. Much of the confusion with respect to culling activity in the trial resulted from figures that were presented in the consultation document which were erroneous. I think there has been an attempt by authors such as Chris Cheeseman and Graham Smith to put the record straight on that, using a model based upon first cull only, and we have hard data to support our evidence. It is described in this document as a guess.

I think that is a silly statement because the data we have is the data that you would collect to give you an assessment of numbers of badgers on the ground and we have done it by using three or four criteria to give us that figure. With respect to other methods of trapping, in Ireland, as you know, they use snares. We were told we could not use snares and we did not use snares. With respect to gassing, just consider the Thornbury area where we do have experience. This was an area of 110 square kilometres with a much lower badger population than we are experiencing now, maybe a quarter of that we are experiencing now but certainly very much lower. It took them over five years to clear that area of badgers using cyanide gas, involving over 500 gassings, so I think to achieve elimination or near elimination is extremely difficult. To achieve the level of removal that we did in the trial is extremely demanding and requires skill from the operators doing it, given the amount of land that one does not have access to, and I have no reason to believe that that will change. Thirteen per cent of the inaccessible land was because one could not identify the owners, so it was illegal for us to get onto that land. To answer your question, there may well be better trapping methods but we do not have any data on that. We can only recall what has happened elsewhere.

Professor Woodroffe: If I could just embellish what Professor Bourne has said, in chapter 10 of the final report, which I am sure you have got copies of, we thought in great detail about precisely this issue and an array of other issues. We thought of every way that we could to improve the effectiveness of badger culling in the broadest sense, or other badger management methods, and everything that has ever been suggested to us we went through and thought very carefully, based upon our own and others' evidence, would this work, would this make it better. Clearly, improving trapping efficiency was one of the first things to think about, and, as Professor Bourne says, we achieved about a 70% reduction in badger activity, and multiple different measures of badger activity triangulate and show the same sort of effectiveness. The other thing that that evidence showed was evidence of substantial badger immigration into the trial areas, and in fact there is a paper which has just come out today in *Molecular Ecology* showing genetic evidence of very widespread movement of badgers into these areas over substantial distances, and I am sure we will be very keen to share that recently published paper with you. As we culled these areas successively, so an increasing proportion of badgers would be getting caught on the boundaries, showing that there was immigration into these areas. What that means is that if, say, rather than removing 80% of the badgers by cage trapping, you used snaring and removed 90%—I am making these numbers up—that does not mean that you are going to have an equivalent reduction in the standing crop of badgers because every time you remove badgers from an area others are coming in from the outside, so if you remove a higher proportion of what was there it may be that you would just have even more coming in.

Q457 Lynne Jones: What about boundaries?

Professor Woodroffe: Precisely, which is why we then looked at boundaries. The sorts of boundaries which Sir David King and his team discussed in their report, motorways, rivers, coastline, came from us and we showed indirect evidence suggesting that what we called hard boundaries, which are pretty substantial boundaries to badger movement, do seem to have an effect because these increases in the prevalence of infection in badgers, which are described in that paper I just circulated, are most substantial where those boundaries are missing, so you do not see such a big increase where there are boundaries, suggesting that badgers immigrating in are contributing to this perturbation and therefore to the increased prevalence of infection. At the same time we did another analysis in which we looked at soft boundaries, other smaller water courses and other little boundaries, and found no effect from those. That was why we said ourselves in the final report that you have in front of you that perhaps culling badgers would be more effective if you could do it within these geographically circumscribed areas, which is what was done in Ireland. The four Irish areas were chosen to be these areas which were comparatively isolated by geographic boundaries to badger movement. They are not representative of the broader areas where TB is an issue, either in Ireland or in Britain, but if you look at a map of the south west area and you look at the distribution of motorways and large rivers, there are not that many.

Q458 Mr Cox: I can think of one straightaway. There is a very large area between the north coast, the Tamar and the A30.

Professor Woodroffe: The northern reaches of the Tamar—actually, that is not a very big river, and at the southern end of the Tamar is a big estuary. I am Cornish.

Q459 Mr Cox: You know it as I do. I represent that area and I can tell you that I would not like to swim it. Have you done it?

Professor Woodroffe: I have not swum the Tamar, no. There are very few areas which are geographically defined in that way, and if you are looking for a policy which is going to affect a large proportion of Britain's cattle farmers that is not a solution.

Q460 Mr Cox: I accept for my own part, representing an area which is a hotspot area, that culling probably is not a solution to the national problem in the sense that we have identified some problems with it, but as a potential instrument, properly co-ordinated, Professor Bourne, which you described, in areas where you can define not perfect but reasonably hard boundaries, it makes no sense,

Sir David King was saying, to rule it out, does it? In a hotspot area where we have an intense infective area, hard boundaries—

Professor Bourne: But if you pursue that approach you have to recognise that there will be winners, there will be losers and there will be disease spread. That is inevitable, and that assumes that the culling is done effectively and systematically.

Q461 Mr Cox: Quite, in the ways you have described?

Professor Bourne: To expect farmers to do that under licence we believe is not realistic.

Q462 Mr Cox: But there I think we can agree. The truth is that I do not think anybody is suggesting that farmers should be allowed to stumble around in the dark with shotguns or any other means. This has got to be a concerted, orderly cull.

Professor Bourne: But this is precisely what the consultation document did suggest, which is why we have caveated our recommendations on the basis that badger removal has no part to play in control of cattle disease, short of elimination or virtual elimination of the badger population over large areas of the countryside. I think that is the nub of the issue. I would have been far more impressed with Sir David's paper had he recognised the non-reality of culling over small areas to impact on the national trend, but if one is to grasp the nettle one has to do this over very large areas to influence national incidence. He has shown you a map of the incidence; I did not see it but I am sure I know what it is, but one is talking about 25,000 square kilometres. You seriously have to ask the question, is culling, in the way that it can be done and in a way that can be achieved, effective? If you believe it is, it is important that you then start looking at the cost effectiveness of that.

Chairman: I am going to draw the line there because that is a good point at which to conclude these discussions. Can I thank you again for coming back. You have been kind enough to come and give us the benefit of your views. We have done our best to understand. I do not think we necessarily would be able to complete a paper that you might want to set about our degree of understanding of all the statistical analysis, but I think we have got a clear message about where you are coming from. Can I also again reiterate my thanks to Professor Woolhouse and Sir David King for coming so quickly to give us the benefit of their views and may I send my early commiserations to Lord Rooker who has to digest everything that has been said, and he is the one who will have to make a decision, but we hope that we will have our report out ahead of that moment when he makes his mind up to give him the benefit of our views. Thank you all very much indeed.

Memorandum submitted by the Former Independent Scientific Group on Cattle TB

I am pleased to let your Committee have our considered scientific response to Sir David King's report, in which he advocates culling badgers as a method of controlling cattle TB nationally. In our response we summarise some of the counter-arguments developed in detail in ISG scientific publications. Sir David has underestimated the powerful arguments showing substantial negative effects on TB incidence in cattle involved in such culling, as well as the formidable logistical difficulties which make such detrimental effects a more likely outcome than the intended benefits.

We believe the report's authors misunderstand a number of scientific issues and, equally seriously, fail to take into account the full range of data on which the ISG conclusions and recommendations to Ministers were based.

An immediate objective of a cattle TB control policy must be to reduce the national disease incidence. We note that Sir David has not commented on the various constructive suggestions made in the ISG report—particularly those relating to cattle-based controls—that we believe would address this objective. The misunderstanding of our mathematical modelling work is particularly unfortunate, and likely to have led him to underestimate the likely benefits of improved cattle based control measures.

Furthermore, to have any positive impact on this control policy objective, badger culling would need to cover much of southwest of Britain and would have to be conducted in a systematic, coordinated way, and sustained for many years. Geographically restricted culling, even over a number of selected areas of a hundred square kilometres or more, could be expected to have, at best, only minimal impact nationally, and would be likely to make matters worse if its implementation were uncoordinated, unsustainable or patchy.

Professor John Bourne CBE

November 2007

Annex

RESPONSE TO "TUBERCULOSIS IN CATTLE AND BADGERS: A REPORT BY THE CHIEF SCIENTIFIC ADVISER"

FJ Bourne, CA Donnelly, DR Cox, G Gettinby, JP McInerney, WI Morrison and R Woodroffe

Former members, Independent Scientific Group on Cattle TB

SUMMARY

- ISG1 The Independent Scientific Group on Cattle TB (ISG) was an independent body charged with developing science-based policy options for the control of tuberculosis (TB) in cattle. As the ISG was dissolved in June 2007 following publication of its final report (Bourne *et al*, 2007), this response to the Chief Scientific Adviser's recent report (King *et al*, 2007) presents the views of the seven former members of the ISG.
- ISG2 A key conclusion of our work was that "badger culling can make no meaningful contribution to cattle TB control in Britain" (Bourne *et al*, 2007). This conclusion is based on the analysis and interpretation of data derived from nearly 10 years' scientific research by ourselves and our colleagues. Our major scientific findings, and their interpretation, have been published in top-quality peer-reviewed journals, and our conclusions are widely accepted within the scientific community. We are surprised, therefore, that King *et al* (2007) reached a different conclusion, namely that "the removal of badgers could make a significant contribution to the control of cattle TB in those areas of England where there is a high and persistent incidence of TB in cattle".
- ISG3 We believe that a key reason for these differing conclusions is that King *et al* (2007) were constrained within their terms of reference, which prevented them from fully evaluating policy options. While we aimed "to present Ministers with a range of scientifically-based policy options which will be technically, environmentally, socially and economically acceptable" (Bourne *et al*, 1998), King *et al* (2007) were "... asked to make comment on scientific issues ..."; their "... brief did not extend to economic or other practical issues" (Environment, Food and Rural Affairs Committee, 2007). Unfortunately, the complex relationship between badger abundance and cattle TB risks, as revealed by our work, means that "economic [and] practical issues"—which determine how, where, when, and on what scale badger culling might be conducted—are absolutely critical in determining whether culling would reduce or increase the incidence of cattle TB. By excluding consideration of such issues from Sir David King's remit, Ministers severely hampered his ability to inform policy development.
- ISG4 In addition to this broad concern about King *et al* remit, we have identified a large number of scientific problems with their report, which have led them to draw conclusions from our work which are not consistent with the data available. In particular, King *et al* (2007) dismiss as "unsound" our finding that badger culling increases TB risks for cattle on neighbouring uncultured land, yet their conclusion is undermined by (i) incorrect interpretation of statistical confidence intervals; (ii)

exclusion of data accrued between the first and second proactive culls, even though this cannot be justified either by statistical bias or by the time taken for changes in the badger population to cause detectable effects in TB risks for cattle; and (iii) incomplete consideration of ecological data consistent with detrimental effects observed among cattle. In addition, misinterpretation of our mathematical modelling work is likely to have led King *et al* (2007) to under-estimate the likely benefits of improved cattle-based controls.

ISG5 Given these concerns, we are not persuaded by the arguments in King *et al* (2007) report and stand by our published recommendations concerning the control of cattle TB in Britain.

INTRODUCTION

ISG6 The Independent Scientific Group on Cattle TB (ISG) worked from its outset to build and interpret a science base to inform the control of tuberculosis (TB) in cattle. As members of the ISG, we analysed and interpreted data from the Randomised Badger Culling Trial (RBCT) and related studies. The ISG was dissolved in June 2007 following publication of its final report (Bourne *et al*, 2007). This response to the Chief Scientific Adviser's recent report (King *et al*, 2007) thus represents the views of the seven former members of the ISG.

ISG7 Our primary findings, including their interpretation, were peer reviewed, both before publication in scientific journals, and by the Defra-appointed statistical auditor; comments were also sought from colleagues at Defra and its associated agencies, some of whom were co-authors on our papers. We have throughout our work encouraged informed debate and discussion, and continue to welcome further constructive comment and dialogue on any aspect of our work.

ISG8 Like King *et al* (2007), we recognised from the start of our work that “the overriding aim is to control TB in cattle”. Indeed, the opening sentences of our final report noted that “Bovine TB is a serious infectious disease of cattle. It has public health implications, has major economic consequences for Government and the farming industry, and causes distress to farmers and their families” (Bourne *et al*, 2007). Hence we firmly agree that “. . . strong action needs to be taken now to reverse the upward trend of this important disease” (King *et al*, 2007). Our recommendations, summarised in our final report (Bourne *et al*, 2007) on the basis of data published in a broad array of peer-reviewed papers, therefore represent our views of the best way to achieve control of cattle TB using methods currently available.

ISG9 A key conclusion of our work was that “. . . while badgers are clearly a source of cattle TB, careful evaluation of our own and others' data indicates that badger culling can make no meaningful contribution to cattle TB control in Britain. Indeed, some policies under consideration are likely to make matters worse rather than better” (Bourne *et al*, 2007). We note that our broad conclusions regarding the role of badger culling are consistent with views expressed previously by experts on the ecology of TB in badgers such as Dr Chris Cheeseman,⁶ Professor David Macdonald⁷ and Professor Tim Roper,⁸ as well as with recent statements by leading scientists charged with past independent reviews of the issue such as Lord Krebs.⁹ However, our conclusion contrasts with King *et al* (2007) recommendation that “the removal of badgers could make a significant contribution to the control of cattle TB in those areas of England where there is a high and persistent incidence of TB in cattle” (King *et al*, 2007).

THE IMPORTANCE OF TERMS OF REFERENCE

ISG10 At the start of our work, our stated aim was “to present Ministers with a range of scientifically-based policy options which will be technically, environmentally, socially and economically acceptable” and the RBCT was therefore designed as a trial of potential policy options (Bourne *et al*, 1998). Our approach contrasts with the remit of King *et al*. (2007), who were “. . . asked to make comment on scientific issues . . .”; their . . . brief did not extend to economic or other practical issues” (Environment, Food and Rural Affairs Committee, 2007). We consider this distinction critical, as we believe it partially explains the difference between our conclusions and those of King *et al* (2007).

⁶ Dr Chris Cheeseman, Oral evidence to Environment, Food & Rural Affairs Committee 2006 “I would venture to suggest now that I do not believe that any culling policy is sustainable in the long term.” <http://www.publications.parliament.uk/pa/cm200506/cmselect/cmenvfru/905/6020704.htm>

⁷ Prof David Macdonald, Letter to The Guardian 2006 “The evidence is that a badger cull on a scale or level of efficiency that seems feasible will not solve cattle farmers' problem” <http://www.guardian.co.uk/environment/2006/mar/10/guardianletters.conservationsandendangeredspecies>

⁸ Professor Tim Roper, Press release on behalf of the Mammal Society 2006 “While we understand the farming community's concerns, we believe the available evidence does not justify a policy of badger culling” <http://www.abdn.ac.uk/mammal/badgercull—press.shtml>

⁹ Lord Krebs, Discussions in House of Lords 2007 “We now know from reading the report of the Independent Scientific Group that culling is not a viable policy option. There is no wriggle room.” <http://www.publications.parliament.uk/pa/ld200607/ldhansrd/text/70726-0001.htm>

ISG11 We recognise three major reasons why the “economic [and] other practical issues” excluded from King *et al* (2007) terms of reference should be given detailed consideration in any scientific discussion of future TB control policy. (i) Although our findings suggest that, in principle, modest reductions in the overall incidence of cattle TB would result from simultaneous, coordinated and repeated culls of badgers over extremely large areas of the countryside, using skilled staff and ideally within geographical barriers to badger movement, trying and failing to achieve this is likely to make matters worse, increasing the incidence of disease in cattle and spreading infection to new areas. As discussed in our final report (Bourne *et al*, 2007), it is highly unlikely that coordinated culls could be conducted simultaneously and repeatedly across hundreds of square kilometres—especially since Defra’s Wildlife Unit was dissolved—whereas our work shows that culling which is asynchronous, patchy, small scale or discontinuous is likely to increase rather than reduce the incidence and spatial spread of disease (Donnelly *et al*, 2007; Donnelly *et al*, 2003; Woodroffe *et al*, 2006b; Jenkins *et al*, 2007). (ii) There are too few natural geographical barriers to badger movement in TB-affected areas of Britain to contribute to national control strategies, while building and maintaining artificial barriers would be extremely costly and highly impractical on the scale at which TB control is needed (Bourne *et al*, 2007; Poole *et al*, 2002). (iii) Even if benefits were achieved by culling, our results indicate that these would be modest in comparison with the substantial financial costs of conducting the widespread culls that would be required. These three issues illustrate the critical importance of the “economic [and] other practical issues” excluded from Sir David King’s remit. Our own consideration of these issues was based on systematic evaluation of ecological and epidemiological data derived from the RBCT and other studies, and our conclusions were reinforced by economic data. We feel that it would have been very difficult for Sir David and his team to reach meaningful policy recommendations without similarly detailed consideration of such issues, and it is therefore unfortunate that their terms of reference were so narrow.

INTERPRETATION OF SCIENTIFIC DATA, STATISTICAL ANALYSES, AND MODELLING RESULTS

ISG12 In addition to this broad concern about the Chief Scientific Adviser’s terms of reference, we wish to express six major concerns about the scientific basis of King *et al* (2007) report. These concern (i) incorrect use and interpretation of statistical confidence intervals in subgroup analysis; (ii) inappropriate exclusion of data accrued between the first and second proactive culls; (iii) failure to consider or cite the ecological data and analyses relevant to our conclusions; (iv) misunderstanding of our mathematical modelling work and its implications; (v) incorrect interpretation of our conclusions regarding temporal trends in the effects of culling; and (vi) over-reliance on assumptions concerning the effects of culling on transmission among badgers. These major issues are addressed below; a point-by-point response to King *et al* (2007) report is provided in an Appendix to this document. This report is also accompanied by copies of three scientific papers describing findings from the RBCT, which have been published in the peer-reviewed literature since publication of our final report (Jenkins *et al*, 2007; Pope *et al*, 2007b; Woodroffe *et al*, 2007). Key findings reported in these three papers were cited in our final report (Bourne *et al*, 2007), referring to the papers as “in press” (in the case of Woodroffe *et al*), “in review” (in the case of Jenkins *et al*) or citing a report to Defra (in the case of Pope *et al*).

(i) Interpretation of statistical confidence intervals in subgroup analysis

ISG13 King *et al* (2007) place great weight on interpretation of results presented in Figure 5.2B of our final report (Bourne *et al*, 2007). This figure shows the results of a subgroup analysis, stratifying overall RBCT results into beneficial and detrimental effects recorded at different distances from the boundaries of proactive trial areas. As is often the case in scientific studies, each effect was presented as a point estimate, associated with 95% confidence limits. The latter give a measure of the uncertainty associated with the point estimate; there will be substantial uncertainty when small sample size prevents a precise estimate from being obtained from a subset of the data.

ISG14 In paragraph 43 of King *et al* (2007), the detrimental effect of badger culling on cattle TB incidence outside culling area boundaries is dismissed since “Three out of four [confidence intervals] go through zero (ie one cannot be confident that the overall effect is detrimental)”. This interpretation is incorrect, as it omits one very crucial proviso in the interpretation of our subgroup analysis. The limits attached to any subgroup of data concern what can be learned from that subgroup of data on its own. While it is useful to know this, it is rarely the primary focus of analysis, and was not so in this case. Indeed if the data are broken into a large number of small subgroups, each on its own will have substantial uncertainty and be indecisive on any issue of concern, even if the overall picture is entirely clear on the point under study, as was the case here. The overall picture must be studied, not fragments of it. This is what we have done in all our analyses, subject to tests of the uniformity of the effect under study.

ISG15 In the interests of consistency, we note that the same analysis showed that all five of the subgroup estimates of beneficial effects of culling inside proactive areas had confidence intervals which included zero. Thus, were the same (erroneous) interpretation to be placed on those findings, evidence of the beneficial effects of culling should likewise have been dismissed.

(ii) *Exclusion of the first year of data post-culling*

ISG16 In our published accounts of the effects of proactive culling on cattle TB incidence (Donnelly *et al*, 2007; Donnelly *et al*, 2006), we provided estimates of culling effects following completion of the first proactive cull, and also following the second cull; the latter analyses excluded roughly a year of data accrued in each triplet between the first and second culls. King *et al* (2007) chose, where possible, to present results from the second cull only, noting in paragraph 29 that our use of the full data set to assess detrimental impacts outside culling areas might “overestimate the effect”. In fact, there is no such bias toward overestimation, nor do King *et al* (2007) put forward any case for such a bias. Since cattle in RBCA areas were tested annually but not simultaneously, some breakdowns detected in the first year would have originated from infections which occurred prior to culling, and some infections which occurred in the first year would not be detected as breakdowns until the second year. Contrary to King *et al* (2007) statement, this would make culling and no-culling areas appear more similar in the first year: the estimated effects on the incidence of detected breakdowns—whether beneficial or detrimental—would be smaller than the underlying effects on the incidence of new infections in this time period. This is important because the exclusion of this initial time period, which cannot be justified on the basis of any bias toward overestimation, appears to have contributed to King *et al* (2007) tendency to downplay the importance of detrimental effects.

ISG17 Paragraphs A16 and A41-A44 in the Appendix give more in-depth interpretation of results from different time periods.

(iii) *Failure to consider ecological data*

ISG18 King *et al* (2007) dismiss detrimental effects of badger culling on cattle TB as “hard to interpret” and “unsound”, noting that they were “not fully persuaded by” our explanation for these effects. In this context, it is unfortunate that King *et al* (2007) appear to have considered only a part of the wealth of ecological data that we have published on the impacts of culling on badger abundance, distribution, ranging behaviour and infection status, citing none of our primary papers on these issues. This work shows that badger culling prompted immigration into culled areas (Woodroffe *et al*, 2007) as well as disruption of badger territories and expanded ranging (Pope *et al*, 2007b; Woodroffe *et al*, 2006a). These ecological changes were associated with reduced clustering of infection in both badgers and cattle (Jenkins *et al*, 2007), and also with elevated prevalence of *M bovis* infection in badgers in both proactive and reactive culling areas (Bourne *et al*, 2007; Woodroffe *et al*, 2006b). These ecological findings are consistent with, and hence support, our observation of elevated cattle TB incidence on land neighbouring proactive culling areas, and in reactive areas.

ISG19 King *et al* (2007) failure to give full consideration to the ecological data is important as it may have given them an incomplete or biased picture of badger ecology and *M bovis* epidemiology, leading to inappropriate conclusions and recommendations. For example, the recommendation to “reduc[e] the migration of badgers into the removal area by . . . soft boundaries (such as arable land with no cattle)” is unsupported by any ecological data and highly unlikely to be effective.

(iv) *Conclusions of our mathematical modelling work*

ISG20 King *et al* (2007) discuss the conclusions of our mathematical modelling work (Cox *et al*, 2005), on which we based our conclusion that “the rising incidence of disease can be reversed, and geographical spread contained, by the rigid application of cattle-based control measures alone” (Bourne *et al*, 2007). We used this model essentially to estimate how close the epidemic is to criticality and hence to infer the likely consequences of policy action, including controls aimed at cattle. Of course all such modelling is based on highly idealised assumptions but it, combined with careful study of all the relevant data that have been collected, is the only rational basis for assessing the likely consequences of policy actions not yet undertaken.

ISG21 Unfortunately, King *et al* (2007) have misinterpreted this work. Cox *et al* (2005) present an explicitly two-species model and the R_0 estimates obtained do not, as stated in paragraph 11 of King *et al* (2007), refer to cattle-to-cattle transmission alone. Rather, these estimates are for cattle within the badger-cattle disease system, and thus represent contributions from both cattle-to-cattle and badger-to-cattle transmission. Indeed, equations 13 and 14 in Cox *et al* (2005) present analytical solutions based on two different assumptions regarding disease levels in the badgers, the first that the badger disease levels stay constant and the second that they follow the increasing

pattern observed in cattle. These equations give indistinguishable fits to the data, and so the true situation cannot be inferred. The important issue for the conclusions presented in Cox *et al* (2005) is that the estimates of R_0 are essentially identical. We agree with King *et al* (2007) that the levels of badger-to-cattle and cattle-to-cattle transmission are likely to vary considerably throughout the UK. However, if the incidence of cattle TB in low incidence areas is driven largely by the epidemic in the South-West of England then the growth rate, and thus the R_0 estimates, for both areas will be similar.

ISG22 We are concerned that the failure by King *et al* (2007) to fully appreciate the structure of this important modelling work, and the estimates obtained from it, will have led them to underestimate the potential for reducing the incidence of cattle TB in Britain using cattle-based measures alone.

(v) *Conclusions regarding temporal trends in the effects of culling*

ISG23 In paragraph 37 of their report, King *et al* (2007) raise the possibility that detrimental effects of badger culling on badger ranging and disease transmission might be “transient”, indicating that we did not consider this possibility. This is incorrect; several of our papers present and discuss evidence for temporal trends in the effects of culling. This issue is discussed in detail in paragraphs A28–A30 below.

ISG24 King *et al* (2007) restrict their discussion to the transience (or otherwise) of disruption to badger spatial organisation; as detailed in paragraph A30 below, there is evidence to suggest that such ecological effects were sustained in proactive culling areas. However, as discussed in Donnelly *et al* (2007), the possibility remains that detrimental effects on cattle TB could be transient—or at least of smaller magnitude following later culls when sustained reductions in badger densities have been achieved—despite continued disruption of badger ecology. We believe that the likely outcome of future TB control options involving badger management can be reliably predicted only through separate, but parallel, consideration of effects on cattle and badgers.

(vi) *Capacity to reduce badger-to-badger transmission by culling*

ISG25 King *et al* (2007) note that “the likelihood of uninfected badgers being exposed to infectious badgers will . . . be reduced [by culling]” (paragraph 38). While such an effect would be expected in the randomly-mixing populations assumed in simple epidemiological models, more complex effects can occur in socially structured populations (Keeling and Eames, 2005). In fact, published data suggest that the substantial reductions in badger density which were achieved by proactive culling (Woodroffe *et al*, 2007) increased badger-to-badger transmission of infection rather than reducing it (Bourne *et al*, 2007; Woodroffe *et al*, 2006b). The likely reasons for this pattern are detailed in paragraph A31 below.

ISG26 Although suppression of badger densities to extremely low levels (substantially lower than those achieved in the RBCT) would be expected to reduce badger-to-badger transmission of infection, no data are available on the densities at which this might be achieved in TB-affected areas of Britain. However, evidence for widespread cattle-to-badger transmission (Jenkins *et al*, 2007; Woodroffe *et al*, 2006b) suggests that even extremely low-density badger populations would rarely remain TB-free. Hence, data do not support King *et al* (2007) characterisation of culling as an “intervention . . . [to] reduce the prevalence of disease in . . . wildlife” (paragraph 5).

CONCLUSIONS

ISG27 In summary, King *et al* (2007) appear to have given incomplete consideration both to the scientific data and to the wider issues critical for determining the likely outcomes of particular approaches to the management of bovine TB. In addition, we have major concerns about their interpretation of our scientific data. Thus, we are not persuaded by the arguments in their report and stand by our conclusion that “badger culling can make no meaningful contribution to cattle TB control in Britain” (Bourne *et al*, 2007).

APPENDIX

DETAILED RESPONSES TO KING *ET AL* (2007) (BY PARAGRAPH NUMBER)

PARAGRAPH 5

- A1 King *et al* (2007) refer to the need for an intervention that would “reduce the prevalence of disease in both cattle and wildlife”. Detailed analysis of the prevalence of *M. bovis* infection among badgers culled in the RBCT demonstrated that prevalence was increased following both proactive and reactive culls, where prevalence is the proportion affected (Bourne *et al*, 2007; Woodroffe *et al*, 2006b). We note that Sir David King’s oral evidence to the Environment, Food and Rural Affairs Committee suggests that his team were envisaging a policy entailing reductions in badger density (ie the numbers of badgers per unit area) similar to those achieved in the RBCT (Q407, Environment, Food and Rural Affairs Committee, 2007). In this context, and in the absence of any data on the level to which population densities would need to be suppressed in order to reduce disease transmission among badgers in TB-affected areas of Britain, we do not consider badger culling able to fulfil King *et al* (2007) criteria for appropriate intervention.
- A2 Proactive culling, as conducted in the RBCT, substantially reduced the density of badgers (Woodroffe *et al*, 2007), and thus it probably reduced the density of *M. bovis* infected badgers despite increased prevalence. However localised reactive culling produced smaller reductions in overall badger density (Woodroffe *et al*, 2007) yet was still associated with elevated prevalence (Bourne *et al*, 2007); hence the density of infected badgers may not have been reduced and could have been increased.

CONCLUSIONS—THIRD BULLET POINT

- A3 We believe that clarity is critical to this scientific debate, and therefore note that the statement that “removal of badgers is the best option . . . to reduce the reservoir of infection in wildlife” is imprecise and potentially misleading. “Reduc[ing] the reservoir of infection in wildlife” could refer to reducing wildlife density, to reducing the prevalence of infection within the wildlife population, or to both. If this wording is intended to refer to a reduction in the prevalence of infection in wildlife, then it is erroneous: as described in paragraphs ISG25 and A1 above, there is strong evidence showing that RBCT culling increased, rather than reduced, the prevalence of infection in badgers (Bourne *et al*, 2007; Woodroffe *et al*, 2006b). If the wording is intended to refer to a reduction in the density of badgers, it is important to recognise the very strong evidence that such a reduction could decrease or increase TB risks to cattle (or both, Donnelly *et al*, 2006; Donnelly *et al*, 2003), depending on the form of culling. There is consistent evidence that if badger culling were to be conducted in a patchy, inefficient, or uncoordinated manner, then subsequent risks of transmission to cattle would probably be no lower—and could possibly be higher—than they were before culling even though badger densities were being suppressed (Bourne *et al*, 2007).

CONCLUSIONS—FIFTH BULLET POINT

- A4 We are unsure of the evidence used by King *et al* (2007) to select 100 km² as the minimal area for badger removal. While this was the scale of RBCT areas, it was clear from our analyses that, when surrounding areas were also considered, the benefits within the 100 km² culled area were largely offset by the detrimental effects on surrounding land (Donnelly *et al*, 2007). Two extrapolations that we considered could be supported by the RBCT data indicated that the minimal area required to obtain a statistically significant overall benefit was either 265 km² (Paragraph 5.41 and Figure 5.4A in Bourne *et al*, 2007) or 455 km² (Paragraph 5.42 and Figure 5.4B in Bourne *et al*, 2007), depending on the assumptions used. Any such extrapolation requires untestable assumptions (by the very definition of extrapolation), yet it is clear from the RBCT data that 100 km² is too small an area to be confident of an overall beneficial effect on cattle TB incidence.

CONCLUSIONS—NINTH BULLET POINT

- A5 As noted in paragraphs ISG13-ISG15 above, we strongly disagree with King *et al* (2007) statement that the evidence for a detrimental effect is limited to the area between 0.5 and 1 km outside the removal area.
- A6 Further, on the basis of RBCT and other data we consider it highly unlikely that the “soft boundaries” mentioned would either “reduc[e] the migration of badgers into the removal area” as stated, or markedly reduce detrimental effects on neighbouring land. These arguments are outlined in paragraphs ISG19 and A34–A35 of this document.

CONCLUSIONS—TENTH BULLET POINT

- A7 While King *et al* (2007) recommend monitoring of cattle TB incidence in the proposed culling areas, we are concerned that no detailed consideration has been given to the precision of the analysis of such monitoring data. Without knowing the spatial extent over which any such culling would occur, it is impossible to provide statistical guidance. More importantly, it would be extremely difficult to obtain reliable estimates of the effects of culling on TB incidence (particularly any detrimental effects in

neighbouring areas) if no unculled comparison areas were available. Indeed, this is one of the reasons why Krebs *et al* (1997) recommended that a randomised controlled experiment be conducted, on an appropriate temporal and geographical scale, to evaluate the impacts of badger culling on cattle TB.

PARAGRAPH 11

A8 As noted in paragraphs ISG20-ISG22 above, the results of Cox *et al* (2005) have been misinterpreted.

PARAGRAPH 14

A9 King *et al* (2007) comment that “. . . cattle movements alone cannot explain the persistence of the geographically compartmentalised areas of high incidence of cattle TB, nor their gradual expansion over the last decade . . .” but provide no evidence in support of this statement. In considering the potential contribution of cattle movements to the geographical spread of TB, it is worth noting that, in western England and Wales, 43% of cattle movements occur over a distance of less than 20 km (Mitchell *et al*, 2005). Hence, cattle movement is likely to contribute to local as well as long-distance spread of infection.

PARAGRAPH 24

A10 This paragraph notes that “most of the areas had only four removal operations”. This is incorrect. The number of proactive culls conducted in each triplet were: A five culls, B seven culls, C six culls, D four culls, E six culls, F five culls, G five culls, H five culls, I four culls, J four culls, giving a mean of 5.1 and a mode of five culls per triplet.

A11 Consideration is given in this paragraph to the non-significant trend for the benefits of culling within trial areas to increase on later culls. While mathematical modelling could be used to extrapolate the likely benefits of conducting further annual culling operations, this would again require untestable or uncertain assumptions (including, but not limited to, how badger recolonisation and birth rates might change with repeated culling, what proportion of breakdowns were due to badger-to-cattle transmission, and how badger ranging behaviour might change with badger density). While detailed mathematical models of the cattle-badger disease system have been constructed (eg Smith *et al*, 2001), considerable detailed sensitivity analyses of parameter values and model structure would be required before their predictions of future benefits could be considered reliable.

PARAGRAPH 25

A12 The RBCT did demonstrate that repeated culling carried out by skilled members of the Defra Wildlife Unit delivered significantly decreased TB incidence in cattle within the 100km² RBCT trial areas (Donnelly *et al*, 2006). However, these beneficial effects were accompanied by detrimental effects in neighbouring areas (Donnelly *et al*, 2006).

A13 With regard to extrapolation of effects of culling over larger areas, paragraphs 5.41–5.42 and Figure 5.4 of Bourne *et al* (2007) provide what we consider to be reliable extrapolations from our results.

PARAGRAPH 27

A14 We are unsure why the increased incidence of cattle TB observed on land neighbouring RBCT trial areas was judged “hard to interpret”. We have published a body of research on this issue and the evidence is considered “substantial” and “strong” by scientific authorities (eg Royal Society, 2006; Shepherd, 2005; Shepherd *et al*, 2005). We have published a number of peer-reviewed papers showing that culling leads to disrupted territorial organisation and expanded ranging by badgers (Pope *et al*, 2007b; Woodroffe *et al*, 2006a), as well as immigration of badgers into culled areas (Woodroffe *et al*, 2007). These ecological changes are associated with reduced clustering of infection in both badgers and cattle (Jenkins *et al*, 2007), and with increased prevalence of infection in badgers (Bourne *et al*, 2007; Woodroffe *et al*, 2006b). The causality of the relationship between culling-induced changes in badger ecology and increased TB incidence in cattle is suggested not only by these broad patterns, but also by details including modification of the effects by factors such as geographic barriers to badger movement, and the practice of non-simultaneous culling (Woodroffe *et al*, 2006b). Indeed, it was the observation of expanded ranging by badgers living immediately outside proactive culling areas (Woodroffe *et al*, 2006a) that prompted us to investigate cattle TB incidence on these lands (Donnelly *et al*, 2006). It is unfortunate that none of this ecological work is cited by King *et al* (2007).

A15 King *et al* (2007) go on to recommend that “measures . . . should be put in place to minimise that increase [in cattle TB]”. This appears to ignore the detailed consideration in paragraphs 10.8–10.48 of Bourne *et al* (2007) which concludes that no practical measures are likely to be able to achieve this. Further details are given in paragraphs A33–A35 below.

PARAGRAPH 28

- A16 As mentioned in paragraph ISG16 above, we consider it inappropriate to exclude data from the period between the first and second culls. The reason for this is detailed in the peer-reviewed Supplementary Information of Donnelly *et al* (2006), which we reproduce here.

INTERPRETATION OF ANALYSES FROM DIFFERENT TIME PERIODS

The main text presents analyses from two time periods, one dating from the completion of the initial cull (which shows statistically significant effects both inside and outside trial areas), and one dating from completion of the first follow-up cull (which shows a significant effect inside, but a non-significant trend outside). The reasons for considering these two time periods, and their implications for the interpretation of our findings, merit further comment.

We used incidence from the date of the initial cull as our primary analysis, mainly because this measure is the most relevant to policy: the effects detected reflect what one could expect to achieve from a proactive culling policy implemented on the timescale measured. As described briefly in the main text, there were two reasons for performing secondary analyses which excluded data from before the first follow-up cull. First, this excluded breakdowns that might have originated prior to the onset of culling, even though (given annual testing) they were not detected until after culling had begun. Such breakdowns would lead to under-estimation of culling-induced effects on incidence in the first year—essentially this would bias estimates of increases or reductions toward no effect. Our findings of statistically significant effects dating from completion of the initial cull, both inside and outside trial areas, therefore indicate the strength of both positive and negative effects of culling.

An additional reason for performing the secondary analyses was that a more complete badger removal would have been achieved from the date of the first follow-up cull. This more complete cull would be expected to generate a greater reduction in cattle TB inside trial areas, and the results of the secondary analysis are indeed consistent with this prediction, albeit with a wider confidence interval due to the smaller dataset.

In contrast with the situation inside trial areas, however, the circumstances of incomplete badger removal that would have occurred between the initial cull and the first follow-up could be expected to increase any detrimental effects of culling, if such effects were caused by disruption of badger territorial organisation at artificially reduced population densities. The frequency of potentially infectious contacts between cattle and badgers will be related to both the density of badgers, and the ranging behaviour of those badgers. We have hypothesised that, where densities are substantially reduced, contact rates will be reduced despite expanded ranging behaviour, but that smaller reductions in density will generate increased contact rates if (as observed) they are also accompanied by expanded ranging. In this scenario, we would expect detrimental effects to be particularly marked following the initial cull since densities were probably reduced to a lesser extent during this period. Our secondary analysis excluded this potentially important time period and this, along with the reduced sample size, helps to explain why the culling effect in ‘neighbouring areas’ was found to be weaker.

PARAGRAPH 29

- A17 As noted by King *et al* (2007), “the detrimental effect was not spread over all of the area [up to] 2km outside the removal area” although we wish to clarify that the analyses to which this comment refers considered distance from the boundary of the trial area, rather than the treatment area (Donnelly *et al*, 2007). Trial area boundaries were delineated mainly along property boundaries, so that herds could in principle be classified unambiguously as located inside or outside the trial area. Treatment areas, within which culling was conducted, were slightly larger than trial areas, and delineated according to the estimated boundaries of social group territories so that all badgers using farms inside the trial areas could be targeted (Bourne *et al*, 2007). As a consequence, some culling was conducted on land immediately adjoining trial areas, but outside their boundaries, and this almost certainly explains the (non-significant) beneficial effect of proactive culling among herds on land 0–0.5 km outside RBC trial areas.
- A18 Our decision to analyse data from all land up to 2 km outside trial areas (except when it was within 2 km of more than one trial area), rather than treatment areas, was a deliberate one, taken to be conservative and to avoid any accusations that data were selected or excluded in order to obtain a particular result. However, the occurrence of apparently beneficial effects within 500m of the trial area boundary would be expected to offset, to some extent, the detrimental effects observed at greater distances and could therefore lead to under-estimation of detrimental effects on uncultured land.
- A19 To provide further clarity on this point, we have repeated our analyses of the incidence of cattle TB on land up to 2km outside trial area boundaries, excluding herds occupying land outside the trial area but inside the treatment area. These analyses, which are presented in Table 1 below, reveal

estimated detrimental effects slightly stronger than those reported in our published papers. These results confirm that our inclusion, in primary analyses, of herds outside the trial areas but inside the treatment areas was conservative and probably led to slightly under-estimation of detrimental effects on uncultured land.

- A20 As discussed in paragraphs ISG13–ISG15 above, it is inappropriate to judge the overall detrimental effect of culling by considering confidence intervals for individual subgroups of data. Also, as noted in paragraphs ISG16 and A16 above, and in paragraphs A40–A44 below, we consider it appropriate to include all data, from the completion of the initial proactive cull, in primary analyses of the effects of culling.

Table 1

Comparison of estimated detrimental effects of proactive badger culling on the incidence of cattle TB on farms up to 2km outside RBCT areas, when herds falling outside the trial areas but inside the treatment areas are included (as in our published analyses, Bourne *et al*, 2007; Donnelly *et al*, 2007) or excluded. Confidence intervals and p values are adjusted for overdispersion as described in our published work.

Time period	Including herds inside treatment area			Excluding herds inside treatment area		
	estimated effect	(95% CI)	p	estimated effect	(95% CI)	p
Using VetNet location data						
First cull to one year after last cull	24.5%	(−0.6–56.0%)	0.057	29.3%	(1.1–65.3%)	0.040
Second cull to one year after last cull	19.6%	(−10.3%–59.5%)	0.22	23.1%	(−7.9–64.6%)	0.16
First cull to second cull	46.8%	(−0.4–116.4%)	0.052	57.0%	(−4.3–157.5%)	0.074
Using RBCT location data						
First cull to one year after last cull	35.3%	(5.8–73.0%)	0.016	43.8%	(9.1–89.6%)	0.010
Second cull to one year after last cull	24.9%	(−7.2–67.9%)	0.14	35.5%	(−1.1–85.5%)	0.058
First cull to second cull	95.4%	(10.5–245.5%)	0.021	95.0%	(3.3–264.3%)	0.039
				57.0%	(−4.3–157.5%)	0.074

PARAGRAPH 30

- A21 King *et al* (2007) found it “hard to compare data” from our report as “figures are presented as percentages rather than as absolute numbers of herd breakdowns”. We are surprised at this concern. It is standard to report percentage differences in risks, and then for these to be translated into absolute numbers for specific considerations, such as cost benefit analyses. Indeed, we give specific calculations for 100 km² areas in Bourne *et al* (2007) paragraph 5.39. These indicate that, over a five-year period of culling, 116 fewer confirmed breakdowns would have occurred within 10 circular 100 km² areas, and 102 additional breakdowns would have occurred in the 10 associated 83.5 km² neighbouring areas. This gives a net overall benefit of 14 fewer confirmed breakdowns (Donnelly *et al*, 2007). Detailed consideration of the costs and benefits of this scale of operation was presented in Chapter 9 of Bourne *et al* (2007).

- A22 King *et al* (2007) suggest that the potential role of cattle herd densities was not considered in our analyses. In fact, the inclusion of the (ln transformed) number of herds as an independent variable in our log-linear regression analyses allowed us to characterise the relationship between herd density and the incidence of cattle TB, since all trial areas were of similar size.

- A23 The full raw data on the numbers of herds, breakdowns and historic breakdowns were provided in supplementary data files published with both papers on the effects of proactive culling (Donnelly *et al*, 2007; Donnelly *et al*, 2006). While we did not specifically report herd densities (per km², for example) in Bourne *et al* (2007), we did provide the number of cattle herds at baseline in Tables 5.1 and 5.7, and the sizes of trial areas are given in the peer-reviewed Supplementary Information of Donnelly *et al* (2006). Hence, relevant data have been publicly available since December 2005 (when Donnelly *et al* (2006) was published online), allowing interested parties to examine herd density effects in further detail had they so wished.

PARAGRAPH 31

- A24 As noted in paragraphs A33–A35 below, King *et al* (2007) comment that “the overall beneficial effect on incidence of cattle TB will be maximised if steps are taken to minimise that detrimental effect” fails to take account of the absence of practical measures likely to minimise detrimental effects.
- A25 As noted in paragraph A7 above, we are concerned that it would be extremely difficult to obtain reliable estimates of the effects of badger culling on the incidence of cattle TB by “monitoring of these effects up to 2 km outside the removal area” if no comparable uncultured comparison areas were available. Indeed, this is one of the reasons why Krebs *et al* (1997) recommended that a randomised controlled experiment be conducted to measure the impact of badger culling on cattle TB.

PARAGRAPH 33

- A26 We consider the evidence for the reduction in badger density achieved through proactive culling to be considerably stronger than “an informed guess”. Multiple indices of badger abundance gave similar estimates of the impact of proactive culling (Woodroffe *et al*, 2007). Several of these indices were based on densities of badger field signs; these were shown to correlate with the numbers of badgers captured per unit area on initial culls, indicating that they are likely to be reasonable measures of badger abundance (Woodroffe *et al*, 2007). Another index used, the density of road-killed badgers retrieved, is a more direct measure of badger abundance and gave similar results (Woodroffe *et al*, 2007). Improved methods for measuring badger density were developed while the RBCT was in progress (Frantz *et al*, 2004; Hounsome *et al*, 2005; Wilson *et al*, 2003) but were not available at the start of the study and so could not be used to monitor culling effects throughout the course of the study. Nevertheless we consider the close agreement between estimates based on different measures to indicate that the effects of culling on badger density were estimated reasonably reliably (Woodroffe *et al*, 2007).

PARAGRAPH 36

- A27 King *et al* (2007) rightly note that clustering of *M. bovis* infection in badgers “was disrupted over the course of the trial and . . . the prevalence of infection in badgers . . . increased”. Their report fails to note, however, that similar changes in the clustering of infection were also observed in cattle: in reactively culled areas, and on land neighbouring proactively culled areas, cattle infections became less clustered as successive badger culls were conducted (Jenkins *et al*, 2007). This change in the geographical distribution of cattle infections reflects expanded ranging behaviour by badgers in the same areas (Woodroffe *et al*, 2006a), contributing to the large body of evidence linking detrimental effects of culling to disruption of badger social organisation.

PARAGRAPH 37

- A28 The conclusions reached in this paragraph are difficult to interpret since it is not clear whether they refer to badger populations inside the culling areas, to those immediately outside, or to both. In either case, the statement that “The ISG considered that the disruption of badgers and the increased ranging behaviour was a permanent effect . . . However, there is a reasonable possibility that the disruption is transient” is misleading in that it implies that the ISG gave no consideration to temporal trends. In fact, Woodroffe *et al* (2006b), Woodroffe *et al* (2007) and Pope *et al* (2007a) sought evidence for temporal trends in the effects on badgers, Donnelly *et al* (2007) and Bourne *et al* (2007) sought evidence for temporal trends in the beneficial and detrimental effects on cattle, and Jenkins *et al* (2007) evaluated temporal trends in the relationship between infections in the two host species. In particular, the Discussion section of Donnelly *et al* (2007) includes several paragraphs proposing an ecological mechanism that might explain the temporal trends observed in cattle.
- A29 The first investigation of any transience of the effects on cattle was not a “simple regression” as stated, but rather a detailed consideration of the stratified data presented in Figure 5.2A of Bourne *et al* (2007). Any modelling beyond the linear regression suggested by the pattern observed over the first four culls would require untestable assumptions and would thus be unlikely to give consistent results over the possible range of parameter values and model structures consistent with the known data. The evidence of the RBCT is clear over the first four annual culls.
- A30 While King *et al* (2007) are correct that “the data do not discount this theory” [that disruption of badger spatial organisation is transient] outside culling areas where data are limited, data from inside culling areas suggest that disruption was sustained. As successive proactive culls were conducted, an increasing proportion of badgers were captured close to culling area boundaries, indicating sustained badger immigration into culled areas with no evidence of this effect levelling off on later culls (Woodroffe *et al*, 2007). Genetic studies likewise show an increasing proportion of the badger population engaging in long-distance movements following successive culls, confirming sustained disruption of badger populations (Pope *et al*, 2007a). Finally, the prevalence of *M. bovis*

infection among badgers rose, and the spatial distribution of infection became less clustered, on successive culls, once again with no evidence of lesser effects on later culls (Jenkins *et al*, 2007; Woodroffe *et al*, 2006b) despite declining badger density over the same time period (Woodroffe *et al*, 2007). All of this evidence indicates that “disruption of badgers” was sustained throughout the course of the RBCT, contrary to King *et al*'s suggestion. In contrast, evidence cannot discount the hypothesis that detrimental effects for cattle may have declined on later proactive culls (Donnelly *et al*, 2007) as the suppression of badger densities was sustained. The reduction in spatial clustering of cattle infections likewise appears to have been greatest between the first and second culls (Jenkins *et al*, 2007).

PARAGRAPH 38

- A31 As in paragraph 37 of King *et al* (2007), it is not clear whether the conclusions reached in this paragraph refer to badger populations inside, or immediately outside, the culling areas. If they refer to badgers inside the culling area then, as detailed above, the statement that “the likelihood of uninfected badgers being exposed to infectious badgers will . . . be reduced, ideally to a level at which TB cannot sustain itself within the badger population” is at odds with the available evidence, which has been published in peer-reviewed scientific journals. Woodroffe *et al* (2006b) showed that the prevalence of infection among badgers increased as successive proactive culls depressed badger density (Woodroffe *et al*, 2007). Moreover, the finding that these infections were also less spatially clustered on later culls (Jenkins *et al*, 2007) is consistent with the hypothesis that disruption of badger spatial organisation led to increased badger-to-badger transmission (Woodroffe *et al*, 2006a). While in principle it is to be expected that extremely low population densities would limit contact between badgers and, hence, badger-to-badger transmission of infection, there are no data to indicate the level of population reduction needed to achieve this in TB-affected areas of Britain. Moreover, there is evidence for widespread cattle-to-badger transmission in Britain (Jenkins *et al*, 2007; Woodroffe *et al*, 2006b), and this could well contribute to continued infection in very low-density badger populations despite low badger-to-badger transmission rates.
- A32 As noted in paragraphs A2 and A3 above, substantially lowering badger density by sustained, simultaneous, coordinated culling across very large areas could reduce the incidence of cattle TB inside culled areas, even though the remaining badgers might experience increased prevalence of infection. However, since the relationship between badger density and TB risk to cattle is strongly non-linear, culling in smaller areas, for shorter time periods, or in an uncoordinated manner will all seriously undermine any beneficial effects of culling and have the potential to generate detrimental effects.

PARAGRAPH 39

- A33 All of the measures proposed in this paragraph were considered systematically in Chapter 10 of Bourne *et al* (2007), and found to be unworkable. For example, we noted that too few existing barriers to badger movement occur in southern and western Britain for these to be used to delineate culling zones over a meaningful proportion of TB-affected areas, and that the mitigating effect of such barriers on the incidence of cattle TB (as opposed to infection prevalence in badgers) was unproven. We also drew attention to the cost of constructing badger-proof electric fences (Poole *et al*, 2002), and the impracticality of fencing any but the smallest culling areas given the number of roads traversing the British countryside.
- A34 We wish to comment in particular on the suggestion of using “. . . soft boundaries such as arable land with no cattle . . .” to minimise detrimental effects on cattle TB. This sort of approach—which we considered in paragraph 10.22 of Bourne *et al* (2007)—would not prevent disruption of badger populations immediately outside culling areas (since badgers regularly occupy arable land). However, this measure could reduce the impact of such disruption on cattle by ensuring that few or no cattle inhabited the areas where disease transmission from badgers was most likely.
- A35 In our view, any such “soft boundaries” would have to be substantially wider than the 1 km proposed. We observed changes in badger ranging behaviour, and detrimental effects on cattle TB, up to 2 km outside RBCT trial area boundaries (Donnelly *et al*, 2006; Woodroffe *et al*, 2006a). Bait-marking studies can be used to derive conservative estimates of badger home range sizes inside proactively culled areas: the mean value was 0.77 km², equivalent to a circle with a diameter of approximately 1 km. Adding one standard deviation to this mean home range size gives an area of 1.34 km², equivalent to a diameter of about 1.3 km. A 1 km-wide band would therefore be fairly small in relation to the scale of badger ranging, and would be regularly traversed by local badgers. We therefore considered somewhat wider bands in Bourne *et al* (2007). To illustrate the scale of effects, if culling were to be conducted within circular 100 km² areas, each surrounded by a cattle-free buffer 2 km wide, each buffer would cover 83.5 km². Buffers would be proportionally smaller (though absolutely larger) for larger culling areas, and would also be larger where culling areas were not circular. We concluded that the costs (in the broadest sense) of excluding cattle from such large areas of the British countryside would be likely to out-weigh the benefits (Bourne *et al*, 2007).

PARAGRAPH 42

A36 This paragraph contains a statement fundamental to King *et al's* (2007) conclusions, namely that our own "... view that this benefit [of proactive culling] was largely offset by the increase in incidence outside the removal area is unsound". We consider this statement to be inconsistent with the data available. As discussed elsewhere in this document, King *et al's* downplaying of the detrimental effects of culling appears to be based upon a number of misunderstandings including inappropriate interpretation of confidence limits (paragraphs ISG13–ISG15), exclusion of data from the initial time period which cannot be justified on the basis of any statistical bias toward overestimation (paragraphs ISG16 and A16) or time delay between performing badger culling and detecting its effects (paragraphs A40–A44), and failure to take full account of ecological data which offer a plausible and consistent explanation for both the detrimental and beneficial effects observed (paragraph ISG18). In particular, the increased incidence of cattle TB observed in herds up to 2 km outside proactively culled trial areas was a consistently observed phenomenon and, given its magnitude, largely offset the benefits of reduced TB incidence among cattle within proactively culled trial areas (Donnelly *et al*, 2007). This offsetting is clearly demonstrated for culling areas up to 300 km² in Figure 5.4 of Bourne *et al* (2007).

PARAGRAPH 43

- A37 As mentioned in paragraphs ISG13-ISG15 above, counting how many confidence intervals of stratified analyses include zero is statistically inappropriate.
- A38 The occurrence of some badger removal immediately outside RBCT trial areas, and the way in which data from these areas were included in analyses, should not have been "unclear" given the detailed descriptions of methodology provided in Bourne *et al* (2007). The "trial" and "treatment" areas are defined in paragraphs 2.11 and 2.12, and illustrated in Figure 2.1. Paragraphs 5.5 and 5.25 indicate that primary analyses concerned herds inside or outside trial (rather than treatment) areas and paragraphs 5.15 and 5.33 make explicit reference to distances from the "trial area boundary". Moreover, paragraph 5.33 states that "... herds ... less than 0.5 km outside the trial area boundary appeared to experience a benefit ... this ... was unsurprising, because badger culling extended just beyond the boundaries of the trial areas to target social groups judged ... to occupy home ranges falling partially inside the trial areas ...".
- A39 To provide further clarity on this point, we have repeated our analyses of the incidence of cattle TB on land up to 2km outside trial area boundaries, excluding herds occupying land outside the trial area but inside the treatment area. These results are presented in paragraph A19 above.

PARAGRAPH 44–47

- A40 King *et al* (2007) note that "it would be reasonable to expect ... a time lag between removal of badgers and detection of changes in infection in cattle" but that "this time lag does not seem to have been taken into account when the ISG collected data on cattle TB incidence immediately after the first proactive removal".
- A41 Our reasons for including data between the first and second proactive culls in our primary analyses are detailed in paragraphs ISG16 and A16 above. Since we considered it likely that the effects of culling might change over time, our publications also presented estimates of effects from the date of completion of the second cull (Bourne *et al*, 2007; Donnelly *et al*, 2007; Donnelly *et al*, 2006) and explicitly investigated changes across different time periods (Bourne *et al*, 2007; Donnelly *et al*, 2007). The suggestion that a possible time lag "does not seem to have been taken into account" is therefore incorrect.
- A42 We discussed this possible time lag in detail in the peer-reviewed Supplementary Information of Donnelly *et al* (2006). Available data indicate that such time lags could be short. This is because (i) behavioural data show that local reductions in badger density affect ranging behaviour within a few days or weeks (Cheeseman *et al*, 1993; Roper & Lüps, 1993; Woodroffe, Macdonald & da Silva, 1995), allowing contact with additional cattle herds; and (ii) once infected, cattle become responsive to the tuberculin test after approximately three weeks (Thom *et al*, 2006). Hence, if badgers can infect susceptible cattle rapidly on contact, increased cattle incidence would be detectable two to three months after badger culling.
- A43 King *et al* (2007) state that naturally-acquired infections entail longer delays to skin test responsiveness than do experimental infections, but provide no data to support this assertion. We are not persuaded that time to responsiveness could be estimated for natural cases since infection dates would be unknown. Thom *et al* (2006) used infective doses of *M. bovis* that resulted in disease similar to that observed in naturally infected cattle, and we therefore consider their experimental findings the most reliable data currently available.

A44 We also wish to note that this concern about time delays refers to our hypothesis about the mechanism whereby badger culling prompts detrimental effects in cattle, not to the existence of detrimental effects themselves. Since there is strong and highly consistent evidence that detrimental effects occur, and since these are costly for farmers, for the farming industry, and ultimately for the taxpayer, it is vital that they be taken into account in developing TB control policy.

PARAGRAPH 48

A45 As discussed in paragraphs ISG18-ISG19 and A14 above, we consider it unfortunate that King *et al* (2007) state that they were “not fully persuaded by” our explanation for detrimental effects of culling yet fail to cite any of our peer-reviewed papers which provide strong support for this hypothesis. As noted in paragraph A14, there is consensus within the scientific community that evidence in support of our hypothesis is “substantial” and “strong” (eg Royal Society, 2006; Shepherd, 2005).

PARAGRAPH 49

A46 As detailed in paragraphs A28–A30 above, the ISG gave explicit consideration to the possibility that the effects of culling might change over time.

PARAGRAPH 50

A47 King *et al*'s (2007) statement that RBCT data should not be used “. . . to either support or rule out a reactive removal strategy . . .” contrasts with their earlier conclusion that “. . . the minimum overall area within which badger removal should take place is 100 km²” (the average area targeted by reactive culling was 8.8 km²).

A48 King *et al* (2007) dismiss our findings regarding reactive culling, partly because this part of the RBCT was “stopped before robust results could be obtained”. We note that the decision to halt reactive culling was taken by Defra ministers; the ISG had recommended that culling be continued while recognising that this might be difficult for Defra to justify (Bourne *et al*, 2005).

A49 Despite this, the consistency of our original results (Donnelly *et al*, 2003) with the findings of subsequent analyses indicate that our conclusions concerning reactive culling are indeed “robust”. Subsequent analyses provide (i) evidence that detrimental effects occur on land neighbouring proactive culling areas (Donnelly *et al*, 2006), making an overall detrimental effect predictable where culling areas are small and hence exceeded in extent by the areas of neighbouring land (Bourne *et al*, 2007); (ii) evidence that the detrimental effect of reactive culling disappeared following cessation of culling, indicating that the effect was not due to a systematic bias between trial areas unrelated to reactive culling (Bourne *et al*, 2007); (iii) evidence that herds located in close proximity to reactively culled land experienced elevated TB risk, even after controlling for the effect of contiguous breakdowns (Bourne *et al*, 2007); (iv) evidence that repeated reactive culling was associated with spatial spread of infection in cattle (Jenkins *et al*, 2007); and (v) evidence that repeated reactive culling, like proactive culling, was associated with elevated infection prevalence in badgers (Bourne *et al*, 2007). This information indicates that it is extremely unlikely that a future reactive culling strategy could contribute to the control of cattle TB, and would probably exacerbate disease spread. Given this evidence we consider it remarkable that King *et al* (2007) failed to “rule out a reactive removal strategy”.

ANNEX 1

A50 In a comment about the use and interpretation of confidence intervals, King *et al* (2007) comment that our inclusion of “decimal points . . . may give the impression of more certainty than is the case.” While we agree that the individual values make sense only to fewer digits, our reason for giving more in this case had a scientific basis: it was to allow any reader wishing to make some additional calculations with the limits to do so without appreciable loss of information from rounding errors.

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Further memorandum submitted by Professor Denis Mollison

TB IN CATTLE AND BADGERS: COMMENTS ON THE CHIEF SCIENTIFIC ADVISER'S REPORT AND ON THE ISG'S RESPONSE

1. This note follows up my earlier submission to the EFRA Committee for their session of 24 October, and includes responses to some issues raised in that session.

I begin, at the request of their Chairman John Bourne, with a brief audit of the ISG's Response to *Tuberculosis in Cattle and Badgers: a Report by the Chief Scientific Adviser*.

AUDIT

2. Having considered carefully both the Chief Scientific Adviser's Report, and the ISG's Response, I am happy to endorse the ISG's main points, as set out in paragraphs ISG3–5, and their more detailed response as set out in subsequent paragraphs, including the key aspect of terms of reference (ISG10–11), and the six points concerning the interpretation of scientific data, statistical analyses, and modelling results (ISG12–27).

3. I trust it is not necessary to go into all the detailed arguments, since I have already set out my endorsement of the ISG's statistical and modelling work and its conclusions in my audit of the ISG's final report, published at the same time as that report in June 2007 (copy attached).¹⁰ Among the conclusions of my audit (section 8 therein), I commended their conduct and analysis of the RBCT as a very thorough and sure-footed demonstration of good science aiding public policy in a complex and controversial situation.

THE CSA'S REPORT

4. The ISG's Response covers most of the six or seven specific criticisms to which I alluded briefly in my earlier comments submitted to the EFRA Committee. I will therefore comment here only on a few specific matters that are not so covered, as follows.

5. First, I stand by my general comment that the Chief Scientific Adviser's Report is inexpert and unbalanced.

¹⁰ Not printed.

6. I am sorry that the Chief Scientific Adviser has interpreted my accusation of lack of expertise as “attacks on personalities”, which it was not. My point was that his report is mainly concerned with detailed discussion of complex statistical modelling and data analysis issues, yet his group lacked expertise in these areas. At the session of the EFRA Committee on 24 October, Sir David neatly confirmed my criticism in attempting to rebut it, when he set out the very considerable expertise of his panel in quite different areas (ecologist and badger expert; immunologist and microbiologist; epidemiologist; expert in veterinary medicine and animal clinical studies, specifically in the area of animal TB; developer of one of the critical tests for cattle TB). [see EFRA Committee Proceedings, Q384]

It is worth noting in this context that the group that previously reviewed the ISG’s work in 2004, chaired by Professor Godfray, did include an eminent applied statistician, Professor Robert Curnow.

7. Since the Godfray Report was referred to several times in Professor Woolhouse’s evidence, including restating that report’s downplaying of the purpose of the RBCT (see Q371) and it’s likely usefulness (see Q380), I should like to make available to the committee my rebuttal of those points (please see Comments on Godfray *et al*, 2004, attached).¹¹

8. As regards balance, the CSA’s Report generally emphasises only points that downplay the detrimental effect of culling. A clear example of this one-sided view is described in the ISG’s paragraph ISG15.

9. In my earlier comments I described the CSA group’s epidemiological analysis as muddled in its discussion of the basic concept of R_0 . To explain: when as here we have disease in two interacting populations, here one=cattle, two=badgers, we have four parameters. For clarity, we should use four different symbols to refer to these—for example, R_{12} to denote the number of secondary cases in badgers caused by one infected cow—rather than using the same symbol R_0 for all of them as in Annex 3. The overall R_0 for the 2-population situation is a function of all four parameters (to be precise, $R_0 = 1/2(R_{11} + R_{22} + \sqrt{(R_{11}-R_{22})^2 + 4R_{12}R_{21}})$). From this little bit of mathematics it is easy to show that the statement in paragraph 11 of the CSA’s report—“If R_0 is below one for all the transmission routes, levels of infection will decline substantially”—is wrong: all four can be below 1, and yet $R_0 > 1$, so that the disease will persist. [For example, when each

$$R_{ij} = 0.6, R_0 = 1.2.]$$

The CSA’s group’s misunderstanding of R_0 is presumably what led to their faulty interpretation of some of the ISG’s modelling work (see ISG21).

10. A rather different point is that in this part of the discussion they implicitly include an assumption, which is more difficult to spot surrounded by mathematics, namely that badger removal will reduce at least the badger to badger transmission parameter (R_{22}) and thus the incidence of the disease in badgers. Unfortunately, the evidence is that this assumption is untrue (see ISG25–26).

11. I should like to put on record my agreement with Sir David King’s preference for avoiding appearing over-precise in the presentation of statistical results (Annex 1)—a point I have adhered to in my own reports on the ISG’s work.

12. To finish with two general comments. First, the EFRA Committee were right to ask Sir David King why he did not discuss with the ISG his disagreements over their analysis and conclusions before publishing his report. One cannot help feeling that more light and less heat might have been generated had he done so.

13. Finally, the single most important difference between the ISG’s and the CSA’s conclusions stems from the latter’s too narrow remit, as discussed in ISG10–11. One might rather have expected the CSA to have set a wider remit, so as to consider options for improved control of TB other than badger culling.

The key point here is that a discussion of science that excludes the practical and economic aspects cannot be adequate as a basis for government action. The Chief Scientific Adviser’s Report therefore cannot provide justification for it’s strong and unqualified policy recommendations.

Professor Denis Mollison

Former Statistical Auditor to the RBCT

November 2007

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Further memorandum submitted by the Former Independent Scientific Group on Cattle TB

RESPONSE TO QUESTIONS FROM THE ENVIRONMENT, FOOD AND RURAL AFFAIRS SELECT COMMITTEE,
[8 NOVEMBER 2007]

FJ Bourne, CA Donnelly, DR Cox, G Gettinby, JP McInerney, WI Morrison and R Woodroffe

Former members, Independent Scientific Group on Cattle TB

1. *Sir David King makes specific criticism of the ISG's interpretation of confidence intervals for the detrimental effect of proactive badger culling outside the specified area. Specifically, King's paper notes that several of these confidence intervals extend below zero, and are fairly wide (para 43)—with the implication that they should be treated with caution. Can you explain the ISG's thoughts on King's analysis in greater detail?*

We discuss this in detail in our response to Sir David King's report.¹² Here is the relevant section of this response:

(i) *Interpretation of statistical confidence intervals in subgroup analysis*

ISG13 King *et al* (2007) place great weight on interpretation of results presented in Figure 5.2B of our final report (Bourne *et al*, 2007). This figure shows the results of a subgroup analysis, stratifying overall RBCT results into beneficial and detrimental effects recorded at different distances from the boundaries of proactive trial areas. As is often the case in scientific studies, each effect was presented as a point estimate, associated with 95% confidence limits. The latter give a measure of the uncertainty associated with the point estimate; there will be substantial uncertainty when small sample size prevents a precise estimate from being obtained from a subset of the data.

ISG14 In paragraph 43 of King *et al* (2007), the detrimental effect of badger culling on cattle TB incidence outside culling area boundaries is dismissed since "Three out of four [confidence intervals] go through zero (ie one cannot be confident that the overall effect is detrimental)". This interpretation is incorrect, as it omits one very crucial proviso in the interpretation of our subgroup analysis. The limits attached to any subgroup of data concern what can be learned from that subgroup of data on its own. While it is useful to know this, it is rarely the primary focus of analysis, and was not so in this case. Indeed if the data are broken into a large number of small subgroups, each on its own will have substantial uncertainty and be indecisive on any issue of concern, even if the overall picture is entirely clear on the point under study, as was the case here. The overall picture must be studied, not fragments of it. This is what we have done in all our analyses, subject to tests of the uniformity of the effect under study.

ISG15 In the interests of consistency, we note that the same analysis showed that all five of the subgroup estimates of beneficial effects of culling inside proactive areas had confidence intervals which included zero. Thus, were the same (erroneous) interpretation to be placed on those findings, evidence of the beneficial effects of culling should likewise have been dismissed.

2. *Table 5.10 of the ISG's Final Report shows that the point estimates from the initial cull and the first follow-up culls (29.3% and 27.3%) are both significant at the 5% level (0.015 and 0.044 respectively). What were the null and alternative hypotheses in these cases?*

The null (H_0) and alternative (H_A) hypotheses were in each case:

H_0 : There was no effect of proactive badger culling on the incidence of all (confirmed and unconfirmed) TB breakdowns among cattle herds up to 2 km outside RBCT trial areas.

H_A : There was an effect of proactive badger culling on the incidence of all (confirmed and unconfirmed) TB breakdowns among cattle herds up to 2 km outside RBCT trial areas.

[Note that the alternative hypothesis is two-sided. In other words, the null hypothesis would be rejected in light of sufficient evidence of either an effect which increased incidence or an effect which decreased incidence.]

So the conclusions are that there was evidence of a detrimental effect of proactive culling on the incidence of all TB breakdowns among cattle herds up to 2 km outside RBCT trial areas both from the initial cull ($p=0.015$) and from the first follow-up cull ($p=0.044$), based on RBCT location data (Table 5.10, page 101 of the Final Report). Similarly, there was evidence of a detrimental effect of proactive culling on the incidence of confirmed TB breakdowns among cattle herds up to 2km outside RBCT trial areas both from the initial cull ($p=0.016$) and between the initial and first follow-up culls ($p=0.021$), based on RBCT location data (Table 5.8, page 98 of the Final Report).

¹² See Ev 101.

It is worth noting that the estimates based on all (confirmed and unconfirmed) breakdowns were (in 5 of the 6 analyses) smaller in magnitude than those obtained in analyses of confirmed TB breakdowns only (compare Table 5.8, page 98 and Table 5.10, page 101 of the ISG Final Report). This was similarly the case within RBCT trial areas (compare Table 5.3, page 92 and Table 5.5, page 95 of the ISG Final Report). While our analyses revealed consistent and statistically significant effects of badger culling on the incidence of confirmed cattle herd breakdowns, there were no similar effects on unconfirmed breakdowns. For this reason we considered it appropriate, from a biological perspective, to focus primarily on effects on confirmed breakdowns, rather than all breakdowns. However, disruptions and costs result from both confirmed and unconfirmed breakdowns, although unconfirmed breakdowns are typically shorter in duration. Both confirmed and unconfirmed breakdowns result in the compulsory slaughter of reactor cattle, movement restrictions on the herd, and additional testing of cattle. Hence, from an economic point of view preventing unconfirmed breakdowns would be desirable, whether or not they indicate the presence of disease.

We would also wish to draw the Committee's attention to further analyses of the incidence of confirmed breakdowns, presented in paragraph A20 of our response to Sir David King's report.

3. *Appendix D of the ISG's report (p205) provides summary data on triplets recruited to the RBCT. Some of the sample sizes recorded (for total badgers culled, culled badgers with TB) look to be fairly small once the total number of culls is taken into account. Does this affect the robustness of the RBCT statistical results and the conclusions that can be drawn from them?*

The numbers of badgers culled per year under the proactive and reactive strategies are detailed in Tables 2.4 and 2.6 (pages 49 and 50), respectively. Regarding the numbers of badgers culled in reactive areas, fewer badgers were taken in reactive areas due to the more limited geographic scale of the reactive culling strategy, compared with the repeated widespread culling in proactive trial areas. Furthermore, the suspension of reactive culling in November 2003 meant that reactive culling was undertaken for fewer triplet years than proactive culling.

The statistical precision of the RBCT results concerning TB incidence in cattle herds was a function of:

- (a) the per-annum incidence levels in trial areas,
- (b) the number of years of observation,
- (c) the number of triplets (10) and
- (d) the consistency of culling effects between the triplets.

The precision was not a function of the numbers of badgers removed.

The number of badgers taken from a trial area on a particular cull is a function of the underlying density of badgers within that area and the proportion of badgers removed. Underlying density will be influenced by the suitability of the environment for badgers, suppression of the population by previous culls (both before and during the RBCT), immigration into the trial area from outside, and the natural growth rate of the population due to reproduction and survival of badgers. The proportion of badgers removed is influenced by the trapping method used, as well as by season, weather conditions, land access, disruption and occupation of traps by non-target species; however our published analyses (Donnelly *et al* 2007; Woodroffe *et al* 2007) detected no evidence of an effect of the last three factors on overall capture rates.

We discussed the impact of culling efficiency in paragraphs 10.10–10.14 (pages 164–5 of the ISG Final Report), and concluded that “improvements in culling efficiency—if implemented in isolation from other changes—are unlikely to generate benefits [in terms of reducing TB incidence in cattle herds] greater than those recorded in the RBCT”. This is primarily because, in the absence of geographical barriers to badger movement, improvements in trapping success would be largely offset by badger immigration into culled areas. We went on to discuss, in paragraphs 10.15–10.24 (pages 165–167 of the ISG Final Report), alternative approaches based on proactive culling and concluded that there was, at present, no practicable culling method likely to generate benefits substantially greater than those achieved by RBCT proactive culling.

While the “sample size” of badgers did not influence the precision of analyses concerning the incidence of TB in cattle herds, these sample sizes did directly affect the precision of estimates obtained in analyses concerning the prevalence of *M bovis* infection in badgers. While the sample sizes were large enough for us to detect various important effects (for example, both proactive and reactive culling were associated with elevated *M bovis* infection prevalence in badgers), it is of course very possible that additional effects would have been found to be statistically significant had sample sizes (ie numbers of culled badgers) been substantially larger. This is, of course, always the case in such a study.

4. *Medical research trials sometimes use significance tests at 1%. Can the ISG's reasons for testing at the 5% level of significance be further explained?*

In assessing the evidence in our data we did not use any specific significance level but reported the precise p values achieved (rather than “p0.05”, for example). One quite widely used interpretation is that if p is roughly 0.05 there is quite strong evidence of an effect beyond the play of chance and if p is roughly 0.01 very strong evidence and so on. But we did not set hard and fast rigid rules for the interpretation of isolated

effects. (This is a widely used approach for interpretation, to be contrasted with rules of hard and fast decision making.) A brief reference discussing these issues is given in Cox and Snell (1981) with a more extended account written for non-statisticians presented in Cox (1982). Furthermore, while p values are a way of reporting the results of statistical tests, they do not define the practical importance of the results.

Although initial power calculations were based on the likelihood of detecting a significant effect (this in turn depending on the assumed significance threshold), later discussions focussed on the precision with which any effect could be estimated (paragraph 2.18, page 37 of the ISG Final Report). We typically reported both the confidence interval and the p-value associated with estimates, where the confidence interval quantifies the precision of that estimate.

5. *If economic costs were excluded from your analysis or calculated in a way that might lead to reduced expense, would the Committee be correct to conclude that the ISG might have reached a different recommendation concerning the desirability of culling?*

Our analyses indicate that modest overall benefits could be obtained by culling badgers in a simultaneous and coordinated fashion across large areas of the countryside, and repeating such culls over several years. However, our experience of overseeing such culling in the course of the RBCT—though over only ten 100 km² areas—leads us to very seriously doubt that culling could be performed in the manner that would be required, particularly following dissolution of the Defra Wildlife Unit. Our results provide consistent and robust evidence that failing to meet any of the necessary criteria—that is, if culls were conducted asynchronously, or in a patchy manner, or not repeated—their effect would be to increase, rather than reduce, the incidence of cattle TB, and to contribute to its geographical spread. This was our primary reason for recommending against a badger culling policy.

These conclusions were not dependent on the economic assessments included in Chapter 9, and would not have been changed by any plausible adjustments to the cost figures used there. The economic appraisal simply reinforced our view that culling could not contribute meaningfully to control policy, but introduced the added perspective that, to be sustainable and defensible, measures also needed to have some economic justification. The evidence showed that culling along the lines of the RBCT could not meet this requirement

In considering other culling methods it was clear their impact on the incidence of cattle TB would need to be incomparably greater than that achieved by cage trapping if they were to approach economic justification. For example, licensed culling by farmers using snares (by far the least expensive means of culling) would need to be 10 times more effective at reducing cattle TB incidence than was RBCT culling (para 9.24). Our discussion of culling options in Chapter 10 of our final report led us to conclude that such enhanced performance is highly improbable. While we did not formally discuss shooting or gassing setts using tractor exhaust, which would undoubtedly be less costly, we consider it unlikely that these could be conducted in the widespread, simultaneous, coordinated and repeated manner that would be needed to achieve benefits. Hence the use of such methods would be likely to increase, rather than reduce, the incidence of cattle TB. Moreover, we are concerned that such practices would not meet necessary welfare concerns. Individual farmers, or small groups of farmers, might feel inclined to try them in pursuit of their own personal benefit, but analysis suggests even so that their financial gains may be illusory while the effect of badger social group perturbation implies potentially severe financial costs to their neighbours.

December 2007

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Letter dated 18 December 2007, from Sir David King, Chief Scientific Adviser to HM Government and Head of the Government Office for Science

BADGERS AND BOVINE TB REPORT

I have seen the comments sent to you by John Bourne and his former colleagues on the ISG and by Professor Denis Mollison in response to my report on badgers and bovine TB in cattle.

Mark Woolhouse, Tim Roper and I have subsequently had a constructive meeting with John Bourne, Christl Donnelly and Rosie Woodroffe at which we discussed our respective reports and their subsequent comments. We all agreed on virtually all of the key scientific issues.

We agree that the scientific data support the conclusion that culling gives an overall beneficial effect on TB in cattle in those areas where there are high and persistent levels of TB in cattle, providing the culling of badgers:

- is done competently and efficiently;
- is coordinated;
- covers as large an area as possible (265 km² or more is the minimum needed to be 95% confident of an overall beneficial effect);
- is sustained for at least four years; and
- the culled areas have “hard” or “soft” boundaries where possible.

We also agreed on the ecological effects, considering that badger culling prompted:

- immigration of badgers into culled areas;
- disruption of badger territories;
- expanded ranging of badgers;
- reduced clustering of infection in cattle outside the culled area;
- reduced clustering of infection in badgers; and
- elevated prevalence of bovine TB within the decreased population of badgers.

Although it does not alter the conclusion that culling could have an overall beneficial effect, one substantial area of disagreement between John and me is over the biological plausibility of the results obtained between the first and second cull. As both the Godfray report (2004)¹ and More *et al* (2007)² note, there is a need to link cause (culling) and effect (herd breakdowns) within a plausible timeframe. Including the results from the first to the second cull reduces (but does not remove) the overall beneficial effect of culling on herd breakdowns seen in the RBCT results. Discounting the initial year of results increases the beneficial effect and decreases the deleterious edge effect.

John and I also differ on the extent of the overall beneficial effect. He considers that it is “modest” whereas I consider that it is much more significant and that the benefits will increase over time with sustained culling. Since the end of the RBCT, Christl Donnelly has been monitoring the incidence of TB in cattle in and immediately outside the proactively culled areas. Christl is continuing this monitoring and further data will become available in the new year.

John’s support for the conclusion that there is an overall beneficial effect can be found in peer reviewed papers (Donnelly *et al*, 2007; Donnelly *et al*, 2006)^{3,4} that he and ISG colleagues published ahead of the ISG’s final report. He acknowledged this when he appeared before your Committee on 24 October and has confirmed it in his answer to question 5 of your follow-up questions in which he says “Our analyses indicate that modest overall benefits could be obtained by culling badgers in a simultaneous and coordinated fashion, over large areas of the countryside and repeating such culls over several years”.

I am disappointed that, in their final report and again in their letter to you, the ISG chose to dismiss this conclusion, not for scientific reasons, but on the basis of assumptions and opinions about the practicality and cost of culling. Unlike the scientific data, these sections of the report and their interpretation have not been peer reviewed. In advising on whether or not culling of badgers might be a policy option for the control of TB in cattle, I would therefore urge you to acknowledge that the scientific data support culling, but that the issues of cost and practicality require more comprehensive and considered assessment than the ISG gave them.

John and I also disagree on whether increased cattle controls alone can bring TB in cattle under control. John believes they can, partly on the basis of a simplified mathematical model (Cox *et al*, 2005)⁵ but also because he overstates the contribution that cattle movements make to the incidence of TB in cattle. I remain of the view that even though TB control by cattle-only measures could have an impact, control which includes measures aimed at tackling the reservoir of infection in badgers will be more rapid and more effective. Given the ISG’s very clear conclusion that badger-to-cattle transmission is the major contributor to herd breakdowns, I would ask you to consider whether it is realistic or reasonable to rely on cattle controls alone.

I am disappointed that the scientific evidence presented within the main body of the ISG final report which supports the conclusion that culling could be beneficial was not reflected in the Chairman's statement in his overview of the ISG's final report "that badger culling cannot meaningfully contribute to the future control of cattle TB in Britain". I am also disappointed that some of his subsequent comments may have misrepresented the situation. Examples are included in my comments, attached,¹² on the more detailed points made by the former members of the ISG and Professor Denis Mollison.

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¹² Not printed.

Monday 26 November 2007

Members present:

Mr Michael Jack, in the Chair

Mr David Drew
Mr James Gray
Dr Gavin Strang

David Taylor
Paddy Tipping
Mr Roger Williams

Witnesses: **Dr Gareth Enticott**, School of City and Regional Planning, Cardiff University, **Dr Chris Cheeseman**, Badger Ecologist and **Dr Robbie McDonald**, Head of Wildlife Disease Ecology, Central Science Laboratory, gave evidence.

Q463 Chairman: Good afternoon, ladies and gentlemen. Can I welcome to the first part of our proceedings Dr Gareth Enticott from Cardiff University, Dr Chris Cheeseman, Badger Ecologist, formerly from the Central Science Laboratory and somebody who has been kind enough to assist us in our inquiry in the past; our additional star witness is Dr Robbie McDonald, I think you were very kind and volunteered to come to talk to us.

Dr McDonald: Last minute substitution I think.

Q464 Chairman: That was very kind of you. You are the Head of Wildlife Disease Ecology section of the Central Science Laboratory. One of the things which is talked about as an ingredient in controlling bovine TB into the future is biosecurity. This is a term which people talk about but do not always define and there is not always a great deal of detail discussed about it. We thought we would get three reputable experts in front of us to try and probe and improve the Committee's understanding of biosecurity. I would like to start, if I may, with Dr Enticott because I read your paper *Biosecurity, "Sound Science", and the prevention paradox: Farmers' understandings of animal health* and I did feel so much better having read it because all the things that you had heard from farmers we have heard them as well. It was quite useful to have the reassurance but I felt that there was a very important point underneath what you were saying about, if you like, some of the—and I use the word carefully—casual as opposed to scientific observations of matters connected with biosecurity. The thesis that you seemed to advance was that farmers carried on with anecdotal reporting about biosecurity issues and that gradually reinforced their views about biosecurity and its effectiveness and therefore made it very difficult to have a more rigorous approach to biosecurity. At the end you seemed to say that we have to change the language in terms of the way that we approach the subject. Perhaps you could just start by talking a little bit about the work and what inspired it and what conclusions you did draw from the way that farmers perceived the term biosecurity.

Dr Enticott: The work is funded by the ESRC which is the Economic and Social Research Council. What inspired it goes back 11 years when I was doing my PhD, living in a village and drinking unpasteurised milk and wondering why all the other villagers were drinking unpasteurised milk when the farms went down with the TB outbreak, so it was an accidental

coming across. The issue for me is that farmers understand risks but biosecurity is different to understanding risk. They have a good knowledge of risk, why their animals might go down with a disease, TB included; their knowledge of biosecurity is different because it is a new word, shaped by what happened during foot and mouth and their reactions to that. Farming is a kind of cultural industry in a sense and they understand that dealing with the disease differs with different styles of farming. Biosecurity is very much associated with a very intensive style of farming. There are some differences in term of the priorities and what counts as biosecurity. If you ask them what it means they will talk about disinfectant straight away; that is the legacy of foot and mouth. They will also talk about fencing straight away in the context of TB, so separating badgers. Then they go down the less serious and things tail off. If you talk to other people you get a very much more holistic view of this. Some of the terms which people use—this is a problem which I will come back to—are different. For example the closed herd differs between farmers and vets and scientists in particular as to what that means; what actually counts as a closed herd differs. A lot of the research we have been doing looks at this mismatch between their experience and what science says about what is good practice, what is biosecurity. This is no different to research done in public health, and preventative measures around public health. Whenever this kind of prevention paradox where you have these very general ideas—keep a closed herd, put some fencing up and that kind of thing—that does not match with our own experience. You will always get exceptions to the rules and it is those things which guide people's behaviour. It also makes people think, in this case in particular, that going down with TB is a matter of luck and farmers—certainly the ones in high risk areas—are very fatalistic about going down with TB. They do not think there is much they can do about it. That is as much an interaction between farmers' own understandings of TB and biosecurity as it is an interaction with the way in which scientists talk about biosecurity in vague terms and in general terms as well. I would also say that a lot of these kinds of activities which that misunderstanding promotes—I could talk about those maybe afterwards—a lot of that is amplified and promoted by what has gone on over the last nine years within

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TB. There are also other things like foot and mouth so that trust element in Defra and in science all promotes this misunderstanding.

Q465 Chairman: You conducted interviews with 60 farmers, some of them in England and some of them in Wales. How many of the farmers you interviewed actually practised good biosecurity as has been advised by Defra. Again, one of the points you make in your paper is that Defra has issued a lot of different bits of advice on biosecurity and I wonder if, in addition to commenting on the degree of biosecurity that you observed in the farmers you interviewed, whether this sort of evolving advice from the Defra Husbandry Working Group had in a way undermined the effectiveness of what are deemed to be good biosecurity measures.

Dr Enticott: It is difficult to say whether farmers have good biosecurity because I guess good biosecurity only matters when there is a risk.

Q466 Chairman: Do you have a working definition of what we mean by biosecurity?

Dr Enticott: There are working definitions.

Q467 Chairman: Did you happen to alight upon one which you felt comfortable with? Can you just give us a flavour because it seems to be a general term that is used by not always defined?

Dr Enticott: My definition is the farmers' definition; I want to know what they understand by it. There is a very broad definition, preventing disease and illness getting on the farm, but that is a very broad definition. Obviously I am interested in what the farmers think about it and what it means to them as opposed to what it might mean to someone else.

Q468 Mr Gray: We are considering whether or not farmers are achieving good biosecurity. In order to work out whether or not they are achieving good biosecurity surely we have to start with some kind of pre-set notion as to what it is they ought to be achieving. Would you say that your definition of biosecurity is that you want to hear what the farmers think it is? Surely we should be saying what we think it is and then ask the farmers whether or not they are achieving it.

Dr Enticott: I understand that, it is a good point. There does need to be some kind of formal understanding of what counts as good biosecurity otherwise farmers will rely on their own views of what it means. Biosecurity is a very ambiguous word; it means a lot of different things to different people. In the paper you have I may say in there that I do not think it is a good word to use. In fact for many reasons I do not think it is particularly helpful to talk about it in relation to TB. We can talk about it in a more general farming context and I think you could argue that talking about biosecurity in relation to TB has wound people up in a sense and generated a sense of distrust and marginalisation from what should be going on to resolve the issue. There are definitional terms which need to be addressed otherwise you do end up with this misunderstanding.

Q469 Mr Gray: My own constituency in Wiltshire is one of the very high risk areas and I know the farmers there very well indeed. I am just puzzled as to what you think maybe farmers ought to be doing, leaving aside the definition of biosecurity. What, in your view, should farmers be doing in places like Wiltshire which they are not currently doing?

Dr Enticott: I do not know what they are currently doing.

Q470 Mr Gray: From the 60 you interviewed.

Dr Enticott: It is not really a question of what they should be doing; I think it is more a question that if biosecurity—whatever that means—is an important part of resolving the problem of TB—if that is the case—then how do you encourage farmers to do that if they are not already doing it? The issue to me is that people have talked over for eight years—and the select committee notes will say this—that we need to develop a better communication strategy between farmers and the Government. I do not think that has happened.

Q471 Chairman: In fairness, Dr Enticott, you are not a scientist.

Dr Enticott: No—I am a social scientist.

Chairman: You observe the phenomenon, in this case of farmer behaviour, in the context of this. Dr Cheeseman may in due course be able to give us a more scientific approach to this.

Q472 Paddy Tipping: You just mentioned, Gareth, the fact that there is no communication strategy between Defra and the farmers. Why is that? Why is Defra so disregarded? Secondly, as a social scientist, you know that people look at good practice; are there are exemplars of good practice that somebody who is highly regarded in the farming community says: "I do it this way" and people would then follow that example?

Dr Enticott: I do not think I said there was not a communication strategy; I said it has not really been developed as fully as it could be.

Q473 Paddy Tipping: Effective communication.

Dr Enticott: You talk to farmers and firstly you ask them what they do with any communication from Defra and they say, "Well, I throw it in the bin". The approach is leaflets and websites; that is not the way to develop trust in terms of encouraging people to change their behaviour, which is one of the things we have to do. If you go back through the years and you look at the Agricultural Extension Services which used to exist, they worked in a completely different way, much more personalised. In the paper that is one of the ways in which, if you are serious about this, then that is what we have to look at. It is interesting that in Wales that is what they are actually trying at the moment, a kind of personalised biosecurity extension service. I am not saying that that is perfect but it is certainly different from what is going on in England and it also certainly fits better with the ways in which farmers understand

information and whom they trust. We talked to farmers and asked them who they trust and they say their vet. I would just say something else as well, I spoke to some farmers around Gloucestershire as well and they all mentioned CSL and it is quite interesting that the CSL might have a role to play in that as well.

Q474 Mr Williams: In understanding farmers' behaviour in this matter I think you have indicated there is a sort of fatalism and you can understand that in a way because in airborne foot and mouth there is very little biosecurity you can take to stop that happening. Farmers are told not to allow badgers to enter buildings and yet they know that once they turn the cattle out to grass they are probably mixing with the same badgers as are attempting to enter the building. That fatalism is bound to continue so long as the farmers see the practicalities of the issue and whatever biosecurity they aspire to will never, ever achieve an absolute protection.

Dr Enticott: That is right and from this sense of fatalism amongst the farmers that I have spoken to it is no surprise they go down with TB at all. They live with TB; it is something they have had to adapt to. If they do not go down it is a surprise and that affects the way they assess risk. Even when you may have a good idea about ways of preventing TB it is that overriding sense of fatalism: why should I do something when I am still going to get it? That is a huge problem.

Q475 Dr Strang: What you are saying is the main reason for farmers not implementing biosecurity measures is because they do not think it will make a difference because they think it is a random event as to whether they will have a breakdown with TB. Is that what you are saying?

Dr Enticott: That is a big part, yes.

Q476 Dr Strang: What about the ones that are implementing biosecurity measures? What reasons have they given for doing so?

Dr Enticott: There are things which become part of farming consciousness and there are modes of good conduct within the communities, things like not feeding on the floor and those kinds of things. Farmers will say to us, "So and so down the road, he still does it; I can't understand why he does that, everybody knows if you do that . . .". So there are things which people accept but they do not override that fatalism.

Q477 Dr Strang: Are there any particular biosecurity measures which you found farmers were taking?

Dr Enticott: They object to being told to fence off their land and buildings from badgers. That is probably one of the main things they object to.

Q478 Dr Strang: Was cost a major factor there, the time and effort involved in doing that?

Dr Enticott: Cost and assessing risk. It may be, but my own personal view is that it comes down to their view of farming and particularly dairy farming in the south west for example being quite an open system and not tending to be intensive. They will use those words "not wanting to retreat behind barricades and barriers" and that is quite culturally important to their way of farming. That is quite important, and the other thing as well is that they would use their own sense of understanding of nature and the ways in which badgers move around and being impossible to control basically.

Q479 Mr Drew: Can I follow up on this notion of the closed herd? I think the most interesting thing you talked about there is my own experience of what we mean by a closed herd. When farmers talk to you they will always maintain that there is a lower incidence of bovine TB where you have closed herds but when they do go down it is has to be a wildlife reservoir. The problem I have always found is that when you then cross-examine and ask if they have brought any animals in you often find that there have been animals brought in, maybe the odd calf, but is this a problem in terms of the science—and certainly the perception of science—about how we can disprove the cattle to cattle transfer at one level but in reality we are not really dealing with something that is pertinent in terms of an ability to isolate that as a factor.

Dr Enticott: There are two things with a closed herd, one is that it really operates as this exceptions rule so that people notice that closed herds go down as much as flying herds or they are in fact more likely to go down in someone with a flying herd and therefore why should I bother with any biosecurity? The second thing connected to that is this definition issue of what is a closed herd. No doubt there are farmers out there who have never brought anything onto their lands in years but then when you talk to others about their herd and they say they have a closed herd but then they talk about the times when things were brought in. That does not mean that they still do not have a closed herd; those are kind of allowances. This is my worry; in talking about a closed herd you have this very generalised idea which therefore allows for this kind of misunderstanding.

Q480 Chairman: One of the things that I am intrigued about is that you talk about this sort of fatalism of the whole process, if Defra brought you in and said, "Okay, we have to redesign how we get the message across about what we think is biosecurity but we are not doing it very well at the moment in the light of your findings", what would you change? How would you design a new programme to get across what might be best practice? What is missing at the moment?

Dr Enticott: I am not entirely sure at the moment that I would change that much in the sense that I do not really understand how valuable Defra see this as a policy. It goes back to what I said earlier, people have been talking about this for a long time. There may be good reasons for that but over the last seven years what has happened?

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Q481 Chairman: Let us be very clear on that, are you saying that by virtue of your observations you do not believe that Defra are actually committed seriously to their own programme and advice on biosecurity?

Dr Enticott: I am not sure how committed they are in the context of controlling the disease.

Q482 Chairman: What evidence do you have to support that?

Dr Enticott: As I said, if you look through, for example, all the select committees over the last eight years, it has been talked about time and time again, better communication strategies, et cetera, et cetera. Eight years after the start of Krebs all that has happened is that there is something on the web, two leaflets that might be developed in some ways but that is not very much. There might be reasons for that. It might be that Defra do not actually want to do this or they do not actually see much value in doing it in terms of its contribution to disease control. There must be a cost to that as well. I could sit here and come up with a lot of good examples of what could be done: follow the Welsh way, do what they are doing and roll that out across the country but that might cost a lot of money and it might not achieve that much, we do not know. It is difficult to recommend something new without knowing the costs as well.

Q483 Mr Drew: Is this not part of a wider problem? We keep going on about vaccination as a strategy always being ten years away. If everybody believes that sometime it will be solved but not at the moment that is where the fatalism comes in. In a sense that is the worst of every world because ten years is too far away to do much about it but it is immediate when it comes and hits you. I am surprised you used the word “luck” alongside “fatalism”. I meet a lot of farmers who believe that it is only a matter of time before they are going to go down again, therefore is it worth taking many preventative measures because they can only work for a limited amount of time.

Dr Enticott: I think one of the things I would say is that the research I have done is in high risk areas for TB and it applies to those areas, it does not apply to those areas outside. If I were outside where they are testing on a four year basis I might have completely different views of this. I do not know because my research did not cover those areas for my own reasons. There has not actually been any research done on those areas and this is one of the things I would suggest should be done. If biosecurity is important it may be better to focus on those areas rather than those high risk areas.

Q484 Mr Drew: I am interested in two aspects of this. What number of farmers were prepared to admit to at least being complicit in illegal killing of badgers and, more particularly, what attitudes did you perceive with regard to that as being an effective strategy in their mind? In other words, did they believe if they felt they had a diseased badger sett on their property this was quite a clever way of at least

trying to deal with that problem for themselves, even though it may make someone else’s problem worse with badgers obviously meandering and so on?

Dr Enticott: I would like to say before I answer that that I do not say this trying to sensationalise this but obviously it does go on and farmers have spoken to me about what goes on. It has been published elsewhere as well by the NFU where they talk about it carrying on. I do not think what I saw is anything different to what other people already know about. Certainly farmers view it as an effective solution; certainly the view taking out diseased badgers as an effective solution. There is the old folklore that you leave your healthy badger and you deal with the unhealthy ones and that very much guides decision making. That would be their view.

Q485 Mr Drew: Dr Cheeseman and Dr McDonald, I would welcome your views on what you have heard from Dr Enticott.

Dr Cheeseman: I would start firstly by saying that I understand this need for a definition for biosecurity and I think that in this particular context it has to include good farm husbandry, that is husbandry that reduces the risks of disease transmission. I think that is what we are specifically talking about here. I know that Robbie McDonald will be able to enlighten you as to some of the recent developments in that area, research that is on-going. It very soon became apparent to us as researchers, that there was a risk on the farm, in particular with respect to buildings. The advice that is given to farmers that has already been mentioned about keeping badgers out of buildings is basic common sense. If you have a disease problem in the area it does make sense to try to exclude badgers from buildings and it is often not too difficult to do that. However, I do understand the point that Mr Williams made that if you exclude them from buildings the cattle are still exposed when they graze the open fields. I think this brings us to the point that you asked Gareth about, why does Defra not do more about it? I think I can offer you an explanation as to where we are at the moment. The problem that we have is that we cannot give farmers specific advice that if you follow this particular regime you will reduce the risks of transmission on your farm by 50% or whatever, and these are the things you must do. We cannot give them a prescription for reducing risk because we do not fully understand at the moment just what the risk factors are and how they rank. I think that the Defra position—some of my ex-Defra colleagues are behind me and I am speaking on their behalf—is that they do not have this specific advice which is why they funded a research programme to try to investigate just these things, particularly with relevance to farm buildings. Some of this research is on-going and Robbie can fill you in on it, but I think it is terribly important that we do things like the TB99 survey which you will be well familiar with. That asked certain questions about the farming practice that might help identify risks. I bet you that one of the high risk factors is badgers being present in farm buildings. Being present is one thing but Robbie might be able to show you some rather

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compelling photographs of badgers raiding feed stores and in amongst cattle. These things can be avoided. If you have a consumptive badger in a situation like that it makes sense to try to prevent it. It is this package that we do not have at the moment which the research programme is designed to address. I think perhaps it is understandable that Defra are not actually going out there in a pro-active way giving farmers a leaflet telling them what they must do. This programme has been talked about a lot in terms of how do we incentivise farmers. There is a certain complacency—or call it fatalism or whatever you want—about the risks of TB on the farm, but I think if we are able to say, “Look, if you ran this sort of practice and you have badgers in your buildings you are increasing your risks by a certain amount and these are the things you can do to prevent it” that would be a very good position to be in, but I do not think we are there yet.

Q486 Mr Gray: You have done an awful lot of work on buildings in particular although, as my colleague said, it does not help from March to November when the beasts are actually out in the fields. Presumably where you have ultra modern units it would be possible to put in badger fences to guard feed stores and guard where the cattle are. However, in the high risk areas in the West Country in particular there are very few ultra modern dairy units of that kind. On your average dairy farm in Devon, Wiltshire or Cornwall it would be virtually impossible to prevent badgers getting in.

Dr Cheeseman: I accept that it is difficult for some farmers to exclude badgers from their buildings. There is one particular case study that we have done on a farm in Gloucestershire where the particular farmer in question is a member of the NFU and has taken really quite painstaking measures to reduce the risks on his farm. This is all of his own volition; he has not been encouraged to do so by Defra. He has raised mineral licks off the ground to stop badgers getting access to them out in the field; he has put his feed stores behind roller shutter doors that he can close off from badgers. I had a discussion with this particular person about the ways in which he could improve even further his biosecurity and that might have included electric fencing. Badgers can be excluded very effectively by electric fencing. I did not perceive it to be too difficult to fence off the whole of this farm complex and keep badgers out. The problem is that he had eight points of access where milk tankers and other vehicles needed to get in and out. The Central Science Laboratory, when I was there, actually designed a grid that was intended to keep animals out of the channel tunnel. It is an electrified grid and it will stop them crossing. It is five metres wide and it is not beyond the wit of man to put one of those in a road. It was possible and it would cost, I accept, a lot of money, probably tens of thousands of pounds. Of course the farmer’s reaction was, “Well, I can’t possibly afford that”. He had previously told me that his run of breakdowns had cost him in excess of £100,000 so I put it back to him that perhaps it was a worthwhile long term investment. His response to that was, “If I do all

these things and my cattle still go down because they are getting infected in the fields, what do I do about that?” I had to concede at that point that he had a fair point, that I could not demonstrate to him just how much of a risk was present in the buildings.

Q487 Mr Gray: The purpose of our study is to discuss culling of badgers and if a farmer is faced with tens of thousands of electronic grids and roads and all that or going out and shooting the buggers, that is what a farmer is going to do. They are not going to put in the measures you talk about, are they?

Dr Cheeseman: No, I accept that. I would say this though, as a counter to your argument, there are some farmers out there who are prepared to take quite considerable measures to protect their cattle against exposure to badgers. There are some who are really diligent. I accept that the majority probably do not give a lot of thought, but some farmers really do want to try.

Q488 Mr Gray: The bigger more modern ones maybe, but I was thinking about the average farmer—particularly in the area we are talking about, the West Country—who has been going through very hard times over the past ten years. The reality is that they are probably unlikely to do all the things you are talking about. They might do some things: they might lift something of the ground, they might put up some kind of badger proof fence around part of it but actually the reality is the really clever biosecurity things that you are describing through your study most normal dairy farmers in the West Country will not be able to implement.

Dr Cheeseman: I do not think some of these measures are going to be that complicated; Robbie will fill you in on some of the details here. We could show you some videos of large numbers of badgers raiding cattle feed stores; it is not difficult to exclude them from these feed stores. They are literally put on the ground on pallets as they are delivered by the lorries and they stay there and the badgers happily come along at night—this is highly concentrated, highly nutritious feed—and they will rip open the bags and have a feast. We have one video with 11 badgers present at one time. That is easy and I put it to you that it would not be very expensive to put food like that in a badger proof store and also administer it to the cattle in a way that does not leave spillage that badgers can gain access to.

Q489 Mr Williams: Is there any evidence that badger behaviour has changed? Before I was a politician I was a farmer on a livestock farm and we used to be out late at night for lambing and calving and it is only in the last two or three years that I have ever seen badgers anywhere near a building. Have badgers always been coming into farm buildings or is only just recently?

Dr Cheeseman: I think it has been going on a long time but what has changed is the law; it is now illegal to kill badgers. I can remember being asked as a teenager to go and shoot a fox that was killing a farmer’s chickens and I sat up and waited for this

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animal to appear. Three of them appeared. I could only see shadows or silhouettes running round and I shot all three of them. They were all badgers and they were in a farmyard killing chickens. That happened back in the 1960s. In 1973 we saw the passing of the Badger Act and it became illegal to kill badgers and since then the law has been tightened even further; you really are restricted by law in anything you do against badgers or their setts. That is what has really changed. It would be true to say that in the past farmers would probably have dealt with that sort of problem quite easily whereas now they are restricted.

Q490 Mr Williams: Is there a correlation between badgers becoming a protected species, a growth in population and their behaviour changing and them becoming more dangerous and aggressive?

Dr Cheeseman: There is an element of truth in the fact that the legislation has probably allowed the population to reach capacity whereas in the past it may have been held in check by activity involving management of badgers by farmers and the shooting fraternity. The idea of a population explosion I think is a myth; there have always been a lot of badgers in this country and we are effectively farming badgers by the pastoral system which is creating ideal habitat conditions for badgers so we have encouraged the high densities that we see today.

Q491 Mr Drew: Robbie, it would be useful if you would now talk to us about some of the practicalities. Could you start by answering one of the issues that we are trying to look at and that is, is there any evidence that biosecurity is better today, despite what Gareth says, in terms of the fatalism of farmers' perceptions but also whether this is making any difference in terms of Defra's strategies?

Dr McDonald: Can I start by referring back to Mr Gray's question about what biosecurity means in this context. I think here we can give you a scientific working definition, that we are looking for means of controlling exposure of susceptible animals—in this case cattle—to sources of infection whether they be cattle or badgers in this case. Really what we are talking about is keeping those two things apart from one another and in this case it is largely going to be physical means of doing so. We started working on this under Chris's direction some years ago with evidence that badgers, particularly tuberculous badgers, were making more use of farm buildings than you would expect and that tuberculous badgers ranged more widely than badgers that were not infected. We have since extended that into video and camera surveillance of the activity of infected badgers on farms. I can show you evidence of this if you look at these photographs.¹ These show the outputs from some still remote camera surveillance of farms in Gloucestershire and I think it is worth saying first of all that it would be entirely reasonable for farmers not to suspect the level of badger activity on the farms that we have observed. Most of this happens very late at night; most of the observation

of activities that we have seen peak at around midnight when farmers have got better things to be doing. We put cameras out in farms and we found that about 50% of farms received badger visits with any frequency and about one in ten receive very frequent badger visits, in excess of 50% of nights.

Q492 Mr Gray: Is that 50% in Gloucestershire?

Dr McDonald: On this sample of farms. So, 40 farms, of which a handful experienced badger visits more nights than not. It is by no means a universal phenomenon but it is common.

Q493 Mr Gray: Sorry, 40 farms of which 50% receive some visits but 10% receive more.

Dr McDonald: 10% receive visits on more nights than not, on more than 50% of nights.

Q494 Mr Gray: So half of them receive visits most nights.

Dr McDonald: Some nights. Let me start again. We surveyed 40 farms and half of them received visits by badgers—so about 20—and four of the 40 received visits by badgers on more than half of the nights that we had been observing.

Q495 Mr Gray: That sounds quite a lot to me.

Dr McDonald: Yes. One in ten farms received a lot of badger activity. That is where these sorts of observations took place and we have a video on our website that you can look at and see some of the phenomena that Chris has described. It is by no means universal but it is very frequent and it is exactly these sorts of areas of focal points of activity on the farm which farmers could take action to prevent exposure between infected and susceptible animals.

Q496 Mr Gray: I have a question on your observations, were they single badgers or on some occasions many badgers? I have heard anecdotally tales of 20 or 30 badgers turning up.

Dr McDonald: You will see in the video if you have the time to look at it there is one example of an entire social group showing up and being chased away by a dog and being back again half an hour later. I reiterate the point that it is one in ten farms that receive visits of that order of magnitude. If I could move to what you do about it, the trial that we are engaged with at the moment is a good example of working with farmers in the local community to try to arrive at practical solutions to this sort of problem. We are evaluating in an experimental way what happens when you install measures to reduce badger activity around these focal points of feed stores and indoor housing. We will be trying out a range of measures including electric fencing and potentially weld mesh installations that stop badgers getting through gates and so on. There are clearly, as you have highlighted already, very serious practical constraints that will limit the uptake of that by farmers but it is part of our role in this project, which Defra supported, to try to work out where the farmers can work around that. We would hope to then demonstrate that there can be major reductions

¹ <http://www.csl.gov.uk/aboutCsl/scienceGroupsAndTeams/wem/badgersinbuildings.cfm>

in those rates of badger visitations experienced by that one in ten farm. It is a practical solution that we are looking at; we are not talking about a channel tunnel scenario that Chris described but one which the farmers can work with on a daily basis.

Q497 Mr Drew: Can we move to the issue of culling now? Obviously, as Mr Gray has said, that is one of the issues that we have been looking at and have taken advice both formally and informally. I suppose my first question to you, Chris, is that if there were this policy put forward to what extent is there the capability to track badgers so that you could carry out the sort of culling that we are told would have to be undertaken to make it an effective policy? Is the surveying means there, given that in the ISG we were talking in terms of up to 80% and the view that has been expressed is that it would have to be 80% plus.

Dr Cheeseman: I understand you have been circulated a little list of some of these considerations.

Q498 Chairman: We have.

Dr Cheeseman: It is a document entitled *Some of the practical considerations associated with badger culling*.² I will take you through that because it is an annotated list. Before I do that I would like to say that I think it is absolutely crucial that you should be considering this in the context of culling and I would like to explain to you why I think it is so important. As you know, I have been studying badgers a long time; some 35 years of my professional career has been spent studying the TB problem. In that time the one thing that I have learned is that it is immensely complicated and there are no easy solutions to this. It is also apparent that people get easily confused about the idea that there is an infected badger so they should be killed. I am afraid it is never as simple as that and there are some issues which I think we need to be aware of that are serious constraints on whether culling can actually make an impact. During that 35 years in the early phase I became very aware that culling seemed to make it worse, in a nutshell, and I developed a quarter of a century ago the idea of perturbation, this idea that if you disrupt badgers' social order you will exacerbate the spread of disease. When I first floated that idea at a meeting with what in those days was called the Badger Management Group I was told by one of the senior members of the State Veterinary Service that it was an unhelpful distraction. Now I had to accept that that was a fair point because I did not have any proof as to what this idea of perturbation might be; I did not have any field evidence. At that time I had to accept that the idea was not good enough, we needed the evidence, which is why I was extremely pleased in the 1990s that the Badger Culling Trial was set up because here, for the first time, we had the opportunity of evaluating the pros and cons of culling. I think that I and a number of my colleagues of the scientific community could be forgiven for thinking that the issue of culling was really well and truly laid to rest when the Independent Scientific

Group published its report in June this year. I would say that that report was exhaustive in its science. The analyses were robust and the conclusions were sound. I have yet to meet a single member of the scientific community that I have spoken to since the publication of that report who disagrees with that. As I say, we thought that that was it but we have recently seen the publication of another report by Sir David King and colleagues which has come to a very different conclusion on the issue of culling. I was extremely surprised at this and I know a number of my ex-colleagues and professional contacts were also surprised. In my desire to understand just why Sir David King had come up with this alternative conclusion I very quickly became aware of some serious deficiencies in the report. I know some of these issues have been summarised for you by the ISG—you have another paper I believe by the ISG which deals with things—but I would summarise them by saying in one area there was a misinterpretation or a misrepresentation or a misunderstanding of some of the basic field data with respect to this negative edge. Secondly there was a large chunk of the ecological data which is so important which was completely left out. It was all there in the public domain; it has been published and it is in the scientific literature. I could not understand why that was not even referenced. Thirdly, I think perhaps the most important deficiency was the failure to understand and even consider these practical constraints on culling. I understand it was not in the remit but I think that was a big mistake. That is why I am so pleased to be able to discuss this with you today because I cannot imagine how anybody could even contemplate resurrecting a policy which will actually make things worse. Over the years I became very concerned that culling—particularly the piecemeal culling—was making it worse and the ISG's report very clearly demonstrates that you would get a benefit in the core of the culled area but you get this large negative effect which eliminates any benefit and unless you cull over a large area—it would need to be at least 300 square kilometres or bigger—and do it in a sustained, coordinated and repeated way you will not get benefits, you will get negative effects that will make it worse. I cannot understand why anybody would want to do that. That is why I drafted this list which I would say is by no means exhaustive and neither is it in any particular order of priority, but these are the main points that occurred to me. Firstly, you would need to decide where you are going to target the culling and across the south west of England, which is the biggest of the hotspots, you have really very hot hotspots and areas of low TB incidence as well, so a big culling area would inevitably probably take in some areas of low incidence. Next you have to decide how you delineate your culled area and I think you are familiar with the issue of boundary permeability, this is the permeability of the boundary to badger movement and the desirability of having a hard boundary that would prevent badgers crossing the edge of your culled area. The one thing I can say to you is that as far as I am concerned, with my

² Not printed.

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experience of badger behaviour, the only real hard boundary is the sea. Roads and rivers do form some kind of natural boundaries to badger movement or the organisation of badger society, but they certainly cross roads. Witness the fact that an estimated 50,000 badgers a year are killed on the roads, which is actually about half of the annual adult mortality, so they certainly cross roads, even motorways. I have seen badgers swim across tidal estuaries so even a big river is not really necessarily a hard boundary. If you look across the south west of England you will see that there is, apart from the sea, a great absence of hard boundaries. The idea of soft boundaries that was proposed in Sir David King's report does not have any field evidence to back it up and in my own professional judgment it would not work. Badgers have, as part of their territorial organisation, some areas of arable land and they do use it at certain times of the year and they certainly cross these areas to gain access to other good foraging habitats, so I do not think that would work. Cattle free buffers have been mentioned and these would need to be at least two kilometres wide and for a 100 square culling area you would need a cattle free buffer zone of 80 square kilometres. Electric fencing has been mentioned as a means of preventing badgers gaining access to areas but on a scale that would be needed for a culling area it would be extremely costly and actually impractical, largely because of the presence of roads; you cannot put fences across roads and badgers cross roads. You have to coordinate this effort over what would be very, very large areas and the Badger Culling Trial data shows very clearly that the marginal benefits that you get in the core area would be reduced by piecemeal culling and you would also need to synchronise the culling over the whole area and sustain it for at least four years to get the benefits. Failure to achieve any of these—that is if you cull in a patchy or asynchronous or unsustainable way—you will risk (a very high risk) making matters worse. So there is a huge cost of failure. Then you have the issue of landowner compliance.

Q499 Chairman: Could I just stop you at that point because I want to ask Dr Enticott a question and then we will come back to this, Dr Cheeseman, in due course. When the Committee visited Devon we had put before us a proposal, which was put forward by the NFU who said they had a programme worked out how they could do a cull of 300 square kilometres, et cetera. I will not go into the detail of that, but you have just given us a set of reasons as to why, unless you have a systematic, hard boundary, well-organised cull things could get worse. Dr Enticott, we have a lot of desperate farmers, some of them whose livelihood has been absolutely disrupted, their business ruined, they are in a state of total despair, they see nothing on the horizon in terms of biosecurity—whatever that means—they know there is a vaccine light years away and the only thing they have got is a gun. Do you think it is possible, given the measured terms of your paper, to convince those people that a cull that they might be invited under those circumstances to take part in, is

not actually the best way forward taking into account the concerns which Dr Cheeseman has just enunciated. How would you deal with that as an issue? If I sent you to Devon and I said, “Go and talk to those farmers there, you are the man who is the expert on getting the message across” how are you going to turn them away from wanting to go and blast every badger that they see out of existence?

Dr Enticott: I am not sure that I could.

Q500 Chairman: Do not have any doubts at this stage. As a communication, a reasoning, a discussion exercise what are the threads of an argument that you might have to put together because it does seem to me that that is a little bit of a juxtaposition between the very measured and reasoned analysis which Dr Cheeseman has just put forward (and we will go through the rest of the points in a minute) and the point you are making about the background into which this kind of analysis has to be dropped.

Dr Enticott: This is a concern of mine in the sense that one of the implications from my research is farmers are fatalistic and are going to do what they want to do whatever; how do you deal with that? I do not know. The other issue is that there are groups of farmers out there and I think you probably spoke to them when you went down to Devon who have said publicly that we are ready to do this, we all agree we need to do it. They are saying that at the moment. I think if that started to happen there would probably be some—many, maybe—who would start to crack and would not want healthy badgers taken out in such an extensive culling. I think the coordination of farmers in that respect would be quite interesting to look at but I do not think would result in what Chris is saying needs to be done.

Q501 Chairman: You have given me a commentary but you have not actually given me a solution. I am going to park you there for a moment and go back to Dr Cheeseman.

Dr Cheeseman: Can I offer a solution? Before the implementation of the culling trial the Independent Scientific Group members went along and we had meetings with the farmers in all the culling areas and I can remember being given a very hard time by some of the farmers that we should not be messing around with a trial, we should be getting on with just killing them. However, they had taken the trouble to turn up, they seemed to want to understand why we were there and I, for one, would be prepared to go back and say to them, “Look, we have got the results of this trial. It illustrates to us that if you start messing around with the badger population in a piecemeal, uncoordinated way you will make matters worse for yourselves”. We can show them in a fairly straightforward way the data and I think we would win the argument. Whether we would win in terms of action on the ground I do not know because there is a lot of frustration out there; it is a desperately serious disease, but that is the way I would approach it.

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Dr McDonald: I think Mr Drew has visited the study site where we are evaluating vaccination work. Chairman, you used the phrase that “a vaccine was light years away”. One would certainly hope that in communicating the development of that particular tool for tackling the disease that it was somewhat closer than that. I believe you will be visiting VLA to hear about that first hand.

Q502 Chairman: Yes, tomorrow.

Dr McDonald: It is certainly rather closer than that and that is part of the package that we could offer to farmers.

Q503 Mr Williams: Can I suggest to Dr Cheeseman that farmers, although they do not understand or do not naturally associate with biosecurity, are actually beginning to understand perturbation. It is not that they do not understand it, but they would say that the problem with a cull was that it was not carried out in a comprehensive and radical manner and that for the reasons that Dr King has put forward they understand perturbation as a problem but actually a solution has been outlined to them and they just wish to be associated with that and would actually probably then engage more comprehensively with the biosecurity issues.

Dr Cheeseman: There are two things to say to that. I have been encouraged by the depth of understanding of farmers on this perturbation issue and I would say that when I developed the idea of perturbation and how it would actually exacerbate the spread it was farmers themselves that were suggesting it. In the early days of some of the badger removal operations—as they were then called—a rash of outbreaks would occur on the periphery and the farmers were saying, “We don’t want this any more; it is obviously making things worse”. That was what led me to develop this idea even more strongly because they were bringing the ideas back to us. In terms of your suggestion that they were saying that we were not doing it thoroughly enough, the problem that the trial has shown is that even at the level of culling that you can achieve by our best efforts in the trial, although you get the benefit in the core area there are winners and losers. The winners are in the core area; the losers are the ones on the outside. I think farmers are beginning to understand that and I do not think a lot of farmers would comply with a culling programme—some of them have told me they will not—because of the elevated risks that they would be suffering. If I were a farmer on the edge of a culled area I would want to know who was going to compensate me when I get a breakdown.

Q504 Mr Williams: But perturbation is not a reason not to carry out a cull; perturbation is a problem to be overcome and you look at it in a logical and reasonable and scientific way and say that the way to minimise perturbation has been outlined by Dr King. I think that is the way the feeling and understanding is moving.

Dr Cheeseman: Dr King has suggested that perturbation can be overcome but I would not agree. If I were to tot up the number of hours or days that the Independent Scientific Group and people like me have spent deliberating on just how it could be overcome, it cannot be overcome because of the lack of hard boundaries. You cannot stop badgers moving around the countryside. Culling actually elevates the prevalence of disease and we also know that infected badgers move further than their healthy counterparts. All of these things stack up so I would turn the argument back on you and say that if you are saying that it can be done in a way that perturbation can be eliminated I do not know of a way and I have spent a long time with the ISG trying to get to the bottom of this. This is why the ISG’s report was so emphatic, that having considered all these practical problems that need to be overcome they cannot be overcome at this point in time. You have also got to bear in mind the badger contribution to this problem. The best estimate in the hottest of the hotspots is 40%; with the average likely to be less than that.

Q505 Chairman: 40% of what?

Dr Cheeseman: 40% of cattle breakdowns are caused by badgers in the worst of the hotspots; this is Sir David Cox’s modelling work. If you take a more realistic average—30% or less—that is the best you can hope to achieve if you eliminate badgers altogether. You are still left with the major component of the problem which is the cattle side of it. That is another consideration for your Committee. Maybe we are spending too much time deliberating on what to do about badgers when we should be thinking more about what to do about cattle. Sorry, that is a bit of an aside but I do think it is relevant. Shall I continue with my list?

Chairman: I think Dr Strang wanted to ask a question before you carry on.

Q506 Dr Strang: It is interesting that you should point out that you and farmers all these years ago identified perturbation and the subsequent scientific research has been able to quantify this and give some further justification for it. As I understand it are you saying that nobody disputes that perturbation happens. Is that right?

Dr Cheeseman: It seems to me that Sir David King was actually drawing into question that finding because he said that some of the findings were “unfounded” and this is the edge effect with reference to cattle. However, the evidence relating to the fact that cattle TB is elevated, all of the parameters that you measure with respect to badgers point to the fact that they move around more, the prevalence is elevated, TB badgers move even more than healthy ones and if you imagine all this disturbance that is taking place on the edges it is easy to see why it can actually exacerbate the spread of disease. I do not think Sir David King has sufficiently taken that on board.

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Q507 Dr Strang: As I understand it they are saying that in Ireland—I do not know whether perturbation exists in Ireland—it is not practical.

Dr Cheeseman: The first thing I would say is that the Irish trials had more hard boundaries round their culling areas, that is the sea. Secondly, I do not think they set up their trial in a way that you could measure that negative edge effect. As far as I am aware there is no data available on perturbation from the Irish trials.

Q508 Chairman: Would you quickly run through the rest of your list?

Dr Cheeseman: Yes, indeed. I touched on landowner compliance and I would suggest that it is pretty certain that the National Trust, the Wildlife Trust and the Woodland Trust for example would not agree with any culling in the light of the scientific evidence and probably, as has already been said, nor would many enlightened farmers because they would not want to suffer the increased risks. You also have a huge difficulty in identifying all the landowners. I think in the trial 13% of the land was never attributed to any landowner.

Q509 Mr Gray: What evidence do you have that, for example, the National Trust would not allow this?

Dr Cheeseman: I am not going to mention any names but we have had contact with the people that evaluate scientific findings for the National Trust and they are completely on board with the ISG's report and they do not believe that there is any evidence to support it.

Q510 Mr Gray: I think we need to be clear about this. I do not think you can really quote people like the National Trust unless you have publicly available evidence that that is the case.

Dr Cheeseman: I would be prepared to bet my house on the fact that they will not.

Q511 Mr Drew: I asked the Woodland Trust on Friday and they were adamant they would never allow a cull.

Dr Cheeseman: To continue, there is the difficulty of identifying all the landowners. The next problem you have is direct action, that is direct action against trapping operations, as we experienced in the trial. If traps are employed they are easy to target and I suggest that the culling policy would be much more likely to receive opposition than the experimental trial. I do not have any evidence to support that but I think that is likely to be the case, especially as the scientific evidence does not support it. There is the question of who should do the culling. The idea of trained operatives—which was mentioned in the King report—would be sensible but the Wildlife Unit has been disbanded by Defra so there is not a body of trained operatives available at the moment. If it were to be farmers then they would need to be licensed and I think there is also likely to be a legal challenge on the issue of licences because the evidence shows that culling can actually make it worse. I suspect that that will not be an easy matter. There is the question of methods of culling. If traps

are to be employed there would need to be a very large number. There are welfare issues associated with any of the methods of culling and I have been involved in all of them. Incidentally the trapping regime that is in place at the moment is one that was devised and developed by my research team. The traps themselves are designed by us but they are inefficient, as you know. The much more efficient method is snaring but that has huge welfare implications and ministers took the decision not to use snares as was originally recommended by Krebs. As to poisoning I think the risks of non-target involvement are too great to even entertain that idea. Shooting, again that has huge welfare and safety implications. There are other welfare issues such as whether there should be a closed season.

Q512 Mr Drew: You did not mention gassing.

Dr Cheeseman: I did not mention gassing but at the moment there is no obvious candidate for gassing. Hydrogen cyanide was suspended because it was found to be inhumane in action. There are certain gasses that could be used like carbon monoxide or carbon dioxide but they would need to be properly evaluated. The problem with gassing is that, as we discovered with hydrogen cyanide, the complex architecture of a badger sett is such that you cannot get a gas, even with power gassing, to penetrate all parts of the sett. When gassing was employed, even though hydrogen cyanide was highly effective, some setts had to be re-gassed many, many times because the badgers were opening them from the inside; they simply were not exposed to lethal concentrations of gas.

Q513 Chairman: Dr Cheeseman, I am going to be terribly rude because our next witness has been very patiently sitting here and he thought he was going to be on at about quarter past five. I have let the conversation run because it has been genuinely helpful, but if you could in the next five minutes draw your observations to a conclusion it would be very helpful.

Dr Cheeseman: I can do it in two. I think there would be a need to sample badgers to monitor TB prevalence. There is the question of who does it and who pays. How do you deal with the negative edge effects? As I have already mentioned, some farmers will suffer an increased risk. Should they be compensated? If so, how wide should the zone be and how long should it be in place and who pays? There are ecological consequences of removing badgers in the ecosystem and Defra funded a very important piece of work a few years ago in association with the trial where we found that if you remove the badgers you get more foxes and possibly as a result of there being more foxes you get fewer hares. Those are two examples. Hares are a Biodiversity Action Plan species in the European Union where there is some conservation concern. We need to bear in mind that badgers are a key species in the ecosystem and if you remove them there will be impacts around the system. Finally on my list—although, as I say, it is not exhaustive—are the implications under the Bern Convention. We

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have already been taken to task once at the beginning of the culling trial and as the person who had to go and argue our case in Strasbourg I can tell you that if we go ahead with a large scale culling trial I think we are likely to be brought back before the Bern Committee to answer for the rationale behind that.

Q514 Chairman: I want to ask each one of you a very short question and yes or no will be a sufficient answer. If ministers were minded to announce that they were going to sanction some form of culling is it important that when they made such an announcement it contained all the elements of the policy, in other words not just the “In principle we think culling could help” but it should also describe how they were going to do it, the modalities of it, the methodology, locations, in other words a complete package. What do you think, Dr McDonald?

Dr McDonald: In terms of a policy I think you will understand if I do not go into the details.

Q515 Chairman: I am not asking you to go into any details, I am just asking if you think it important that if they were to make an announcement—hypothetically speaking—that they were in favour of a resumption in culling, that you could not announce that as a point of principle without at the same time announcing the detail of how you were

going to do it, where you were going to do it, how it was going to be funded. In other words, the complete package.

Dr McDonald: I think the science that would underpin that case would be vital to the programme’s success.

Q516 Chairman: Dr Cheeseman?

Dr Cheeseman: I would say yes for the same reason; it needs justifying action.

Q517 Chairman: Dr Enticott, what do you think?

Dr Enticott: I think farmers would like to see an announcement.

Q518 Chairman: One way or the other.

Dr Enticott: To a certain extent yes. I think they are fed up with waiting to be honest. That has certainly been made strongly towards me when I was doing my research. They feel like they have been left alone and whatever way it goes they would like to have heard that a long time ago.

Chairman: I am now going to invite Professor McInerney to join us; my apologies that you have had to wait a little longer than we had bargained. May I thank all three of you for your contribution both in written form and your remarks, and also Dr McDonald for the photographs which are very useful indeed. If you are staying—you do not have to stay—and there is anything that comes up in the next bit that you want to comment on do please let us know.

Witnesses: **Professor John McInerney OBE, FRSA, FRASE**, former member of the Independent Scientific Group; gave evidence; **Dr Chris Cheeseman**, Badger Ecologist, gave further evidence.

Q519 Chairman: Professor McInerney, you have been patience personified sitting and listening to all our discussions. The Independent Scientific Group were very clear in their final report, going beyond the discussion about the effect of the trials, and they gave us a piece of economic analysis and it was unequivocal which effectively said that culling was not a paying proposition; to put it in layman’s terms it was uneconomic. Could you just tell us how did the calculations come about? How did you actually work out the costs that were involved? What was the source of the data and how did you come to your economic conclusions?

Professor McInerney: Might I just say in starting, Chairman, that the ISG came to its conclusions about the ineffectiveness of badger culling as a policy long before any economic analysis was done. It was not at all hinging on the economic analysis but for completeness as we explored the search for sustainable practical policies. I guess that because there was an economist on the group I insisted that all recommendations ought to have an economic dimension and the economic analysis simply reinforced the kind of arguments that Chris Cheeseman has just given. The ISG was not at all determined in its recommendations by that analysis. How did the analysis get done? Using the fairly standard, straightforward way in which you would assess any disease. You would ask questions like

how much disease reduction do your efforts result in? What is the cost of all these efforts? You put the two together in monetary terms and ask is it worth it? An economist would say that the questions are a bit wider than that: Who else benefits? Are there any other benefits? At the open meeting of the ISG in June I was castigated in talking about this because I had not included the benefits of badger culling on the population of hedgehogs. As one explores these things there are all sorts of costs and benefits other than the direct ones: costs of policing, costs of training, the actual value of the badgers that are culled and so forth. In our assessment we took a very simple approach. We did not try to do a full cost benefit analysis; we simply tried to say: taking the kind of disease reduction effects that you can get from culling as evidenced in the trial, what were those disease reduction effects worth in economic terms and what were the costs that had to be incurred in trying to attain them? I must say that the main source of the detailed information for doing these assessments was the cost benefit analysis undertaken by the Defra economists for the consultation exercise that Defra did in 2005. As part of the background to that the economics group in Defra looked very closely at four different types of badger culling. Cage trapping as conducted in the trials, although they recognised that the trial was a research exercise so it was not actually the costs of

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cage trapping in the trial but costs of doing that kind of trapping as an administrative policy, in other words take out all the research costs. They looked at gassing; they looked at snaring; they looked at farmer licensed culling which was again one of the proposals. Although the consultation exercise thought that farmer culling might involve shooting it was snaring that the cost benefit analysis looked at. It built up these costs from first principles and it tested them pretty much against the evidence available from other sources and so they were very respectable estimates of the costs. I felt very impressed by them and very confident in recommending that we use them. It happened that the benefit analysis that was part of that study was much more speculative because the trial results had not come out so there was no calculation of the disease reduction effects of badger culling. They had to take the approach of break even analysis: how much would it have to be reduced to cover the costs? There was a very good estimate of what the benefit of saving one herd breakdown was.

Q520 Chairman: Was there a wide variation between what I might call a professionally managed cull—which is what the trial was—and a farmer undertaking a cull? Was there a big difference in cost?

Professor McInerney: Yes.

Q521 Chairman: You have come out with some figures. I think the figure quoted was £27,000 per breakdown; was that the professional trial number as a cost or was that based on something else?

Professor McInerney: That is basically the cost to the economy of a confirmed herd breakdown. If a herd breakdown occurs it would cost the economy a total of £27,000 made up from the cost of slaughtering reactors, of restrictions on farmers, on the extra testing that has to be done post-disclosure, on the laboratory tests on confirmation, on the contiguous tests on other farms chasing breakdowns and also on the onward transmission, in other words the secondary effects of a breakdown that may result from a first one. That was pretty much the basic cost of a herd breakdown and therefore what you save by preventing a herd breakdown, whichever method you use to save it.

Q522 Chairman: Let me pose the question another way. As far as I can see from the notes in front of me, you analysed that the culling policy cost £10 million for a total benefit of less than £2 million. I am trying to get a feel as to what the main differences in cost would be between a professionally done cull—which is what I recognise the trial was—and a sort of do-it-yourself cull. If you simply said to farmers, “Okay guys, you’re going to run a 300 square kilometre trial; you’re going to be responsible for doing it”, in other words all the costs of doing it are down to the farmers.

Professor McInerney: You need to keep separate in your mind the cost of doing a cull and the benefit of preventing a breakdown. The benefit of preventing a breakdown is exactly the same to the economy

however you prevent it, whether it is fortuitous or whatever method you use. That £27,000 is a pretty standard unit benefit of reducing breakdowns. In evaluating whether a policy is worthwhile you say: What does it cost us to try and get this £27,000 of benefit? There is quite a range in the most expensive way of doing it which was doing it via cage trapping, by Defra staff and the whole Defra superstructure, and the analysis also assumed that gassing and snaring would be done by Defra staff. It works out somewhat cheaper but nevertheless is an expensive way of trying to clear the badgers from one square kilometre or 100 square kilometres (I did all my calculations on a 100 square kilometre basis). When you get to farmer culling you can then say that that would be cheaper because a lot of the costs are embodied within the farmer’s own cost structure: he uses his own land rovers and uses farm labour and so forth so the costs come down somewhat. However, there are still costs within there accruing to Defra as well. It is not assumed you totally privatise it; there has got to be administrative costs, there has to be monitoring costs and so forth that need to be included. Allowing farmers to do it is by far the cheapest way if you are looking for a cheap way of doing it. The big question in doing a kind of economic assessment is: Can you take the effectiveness of professional cage trapping in reducing breakdowns and can you carry that forward to every other method of culling? Simply for purposes of analysis, because there was no scientific data on what would the impact of gassing or snaring or farmers killing badgers be on breakdowns, we carried over an assumption—which we regarded as a high side assumption—that if you could do culling as good as it was done in the trial then taking that estimated benefit stream would the costs of these other methods make it seem worthwhile? It was actually fairly simple; it was not really economic analysis, it was really accountancy. Economists are very sniffy about accountancy as opposed to economics because economics has a conceptual framework and is much more complicated and would cause people’s eyes to glaze over and so forth, (which I may be doing already). It was this simple analysis of taking what the estimated effects of culling might be and therefore if you look at the table in our chapter nine it uses the same stream of benefits for whatever methods. The only choice between them was the cost of them. It was only when you found the cheapest possible method that one got to anywhere near finding a kind of break even, assuming you ignored the edge effect. It was simply taking the direct disease reduction effects as demonstrated in the trial and valuing them which, as you know, we found largely neutralised by the edge effect.

Mr Gray: If the work which you did on cost benefit analysis came, in time terms, after the work was done on the benefits of culling by the ISG and the ISG came to the conclusion that there were no benefits of culling, then quite plainly if one pound was spent that would be a poor result. By contrast, I presume, if we were to come to the conclusion that culling was going to be 100% effective—

Chairman: What is your definition of effective?

Q523 Mr Gray: Effective means the removal of TB in cattle. At the moment the Government is spending £91 million a year on compensation and the rest of it. I am not saying it is, but let us imagine that scientifically you could prove that culling would be 100% effective and would remove it all, and let us imagine equally that the cheapest way of doing it was to let the farmers do it in an organised way, the cost would be zero and the benefit would be huge. Am I right in suggesting—I am not trying to put words into your mouth—that given the parameters we were working under, within the parameters laid down by the ISG, quite plainly the cost benefit analysis would come out wrongly because obviously they conclude culling was wrong and therefore any money spent would be too much. If, on the other hand, you did it the other way round and you said: “Let us find a cheap way of doing it, let us get the farmers to do it”, for example—an NFU organised farmers’ cull—and let us imagine that was a bit effective in reducing the £91 million the Government currently spend, the results of your analysis would be different.

Professor McInerney: That is not a fair interpretation. The ISG findings did not say there are no benefits of culling; it did in fact find that there were benefits of culling, ie 25% reduction within the culled areas, to a large extent neutralised by the edge effects. The actual predictions in terms of numbers of breakdowns were that over a five year period, in simple terms, in 100 kilometre square area you would have expected about 50 breakdowns; culling within that area prevented 12 but around the outside another ten got created. There was the net benefit: two breakdowns saved over the five years. In technical terms you do not conclude that there were no benefits; the discussion that the ISG went through was looking at all the different ways you could cull, is it possible to get something other than a pretty insignificant disease effect? There was a large discussion of different ways of culling, of different methods and the argument was that they do not look as if they could deliver what the cull did and the best you could do was think of getting to very much larger areas.

Q524 Mr Gray: Given that was the broad conclusion they came to—that there was no particular purpose in culling, it did not really work very well—then clearly any costs of any kind at all, even a minute cost, would be a waste of money.

Professor McInerney: No. If you can prevent two herd breakdowns in a 100 kilometre culled area for anything less than £54,000 there is a financial benefit because two breakdowns saved are worth £54,000. The conclusions of the ISG towards badger culling and the fact that it really was not a meaningful contribution to a sensible policy, is given that it only seems to account for 25% of the disease anyway. The big problem is resolving the other 75%.

Q525 Mr Gray: If you ask Sir David King to use your methodology you might well come to a completely different conclusion because he considers

there was some purpose in culling. Am I not right in thinking that your conclusions are based on the parameter laid down by the conclusions arrived at by the ISG anyhow and if you used your cost benefit analysis in the Sir David King context you might well come to a completely different conclusion.

Professor McInerney: I do not know what reduction in disease incidence Sir David King is predicting would occur following the kind of culling policy that he proposes, but culling is an expensive way of trying to reduce breakdowns. Even if it is done by way of farmer culling it is still pretty expensive. The point is that you have to find cheap ways of achieving what are not major reductions in breakdowns. A lot of the argument does hinge on the fact of whether farmer culling—if that is the alternative you look at—can achieve the kind of performance that the professional culling in the trial did? You have just heard Chris Cheeseman argue—as we do in our report—that whichever way you slice it there are so many difficulties in doing it the privatised way, as it were, that it is difficult to imagine that you could get the kind of disease reduction effects that the trial managed to achieve.

Q526 Chairman: Dr Cheeseman, I know you are sitting in the back row now, but one of the things that comes out of this discussion is, I suppose, the proportionality effect. In other words, you culled the way you did and you got rid of 25% of the disease; could you have culled with greater vigour, more frequently, taking out more badgers? In other words, if you increased the intensity of the culling, first of all is it possible to do that and, if so, what would be the effects on the amount of disease taken out? Or was it the case that you put in an efficient method of culling and that is what you got out of it, in other words, you cannot go more than 25%?

Dr Cheeseman: I would have to refer to Sir David Cox’s analysis where he was able to model the disease and come up with a figure of a maximum of 40%, so that is your denominator. Most people would agree that it is somewhere between 30 and 40% contribution at the moment; that is your target. If you are getting 25% reduction in the trial the maximum you could expect to achieve is somewhere between 30 and 40% just by dealing with badgers.

Q527 Chairman: To be clear, to get between 30 and 40% over what, four years?

Dr Cheeseman: Yes, four years.

Q528 Chairman: To achieve that you have to have a continuous intensive cull by whatever method you choose and you have to keep going back and back and back and doing it to get to that kind of situation. Even if you did get to 30 or 40% by definition between 60 and 70% of the disease still remains.

Dr Cheeseman: Yes. To answer the second part of your question could you achieve a higher level of benefit by more efficient culling, I do not know really but I think that it is likely that even the most draconian methods such as snaring and gassing or

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poisoning (which would probably be the most efficient of all) all carry such huge risks that they are not really practical.

Professor McInerney: Can I just add that quite logically, if you removed all the badgers from an area of land and stopped any more badgers coming in, you would completely eliminate the badger risk of TB because there are no badgers there to represent badger risk so all your TB must be due to something else. It is technically impossible, it would seem, to get rid of all the badgers—I suppose very draconically you could get rid of all the badgers—but somehow you have to stop them coming in as well; goodness knows how you do that.

Dr Cheeseman: That is the important point. Immigration is a key factor.

Q529 Chairman: I think what Professor McInerney is saying is that even in the hypothetical situation that you hermetically seal the test area, that you have got rid of all the badgers, there would still be something left in terms of disease.

Professor McInerney: There is still 60 to 65% of the disease left. Given that badger culling has to be thought of practically, in the modelling that David Cox did (I would suggest that some time you look at pages 147 to 149 of the report) even if the efficiency—if the proportion of badgers you were able to cull—was as high as 90% this was not predicted to have a much different impact on disease reduction nor if efficiency was 10% less than achieved in the trial. Once you start taking the badgers out you are creating this perturbation; this is where your negative effects come in and they dominate so much of the outcome.

Q530 Mr Williams: Surely the argument is that nobody disagrees that there is cattle to cattle transmission but that is being borne down on by all the efforts that are put into skin tests and pre- and post-movement testing and culling of cattle. The issue is that having undertaken all those exercises there is re-infection all the time from the badger population. That is the issue, is it not? If you did have a badger free area then through the process of testing of cattle and slaughtering of cattle you would probably achieve a clearance of TB.

Professor McInerney: You are right in saying that, in that while badgers are there there will always be a risk of badger infection. If you wish to eradicate TB you would ultimately have to tackle the badger source of infection. However, in the face of rising incidence the policy problem is actually to reverse the level of incidence. Eradication may be an objective in N years' time but Defra's own strategic vision for TB is: lower the economic impact, prevent the geographical spread and then lower the incidence. And mathematical modelling suggests that given that the weight of infection seems to be coming from the cattle based element the more logical question to ask is: How can we better do that bit to start turning the disease down rather than how it can be better to do the badger culling bit? There is a good economic analysis to be done there as to whether the economic assessment of disease control

measures focussed on cattle show a much higher economic return than seems to be possible to find in the culling approach.

Q531 Mr Williams: That is the issue I was going to come onto now. Does it show a better economic return? As Mr Gray said, we are spending £91 million and the incidence of the disease is increasing. In comparison to perturbation that we have been talking about, perturbation is peanuts compared with the efforts that we are putting in now, the cost we are putting in and the increase in the disease. The disease is out of control.

Professor McInerney: We are spending £80 or £90 million and not controlling the disease, so one is looking for ways in which some marginal £10 million, say, will change the impact of the disease. The estimates that we have looked at say that that £10 million is not best spent on badger culling, it would seem. The possibilities from a technical scientific point of view of finding far greater disease reduction benefits—as the mathematical modelling said—are more frequent testing, better testing, somehow taking out infection from the cattle population more effectively. This is likely, in a technical sense, to have more impact on turning the disease down. We do not know the economics of that because that is a research exercise.

Q532 Mr Williams: We have already had the experience of increased testing. People have gone from once every three years to once every year and the whole slaughter thing, and yet the disease has continued to increase which would lead you to suppose that actually increasing the intensity of testing and all those sorts of issues will make very, very little difference at all while you have got a reservoir infection in the wild.

Professor McInerney: One keeps saying reservoir as though the rise in incidence of the disease is due to badgers. While there is a reservoir you will never totally eliminate the disease but if you have two sources of infection hitting your cattle population the issue is: which is the most productive source to tackle? It does not look as if badger culling is all that effective.

Q533 Chairman: Sensing where Mr Williams is coming from, if you put all the emphasis on the cattle side, you have not closed off the source of infectivity. Going back to the earlier discussion we had about whatever we mean by the term biosecurity we have not found some way, if you like, of sealing the cattle off from outside sources of infection whilst we are busy testing and removing infected animals. How do you break that cycle?

Professor McInerney: You cannot, it would seem, hermetically seal a cattle population from infection and there will be an environmental risk factor all the time there are badgers there. If you took a kind of risk based approach to reducing the incidence you would ask: Where are the higher risks or which are the risks that can be most effectively tackled? The ISG's trial results suggest that the badger risk is not easily or very effectively tackled but a lot of the other

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discussion in the whole of that report is that the cattle based risk is better and more likely to be more effectively tackled, which is why we offered a spectrum of approaches rather than just saying, “No good doing culling, mate; forget it” and walk away.

Q534 Mr Drew: One of the problems with a mass badger cull is that by the very nature of this disease you are culling badgers that do not have TB, that may be immune from bovine TB in the same way that we do not often now cull the whole of the herd, there are cases where there is a whole herd breakdown but we tend to keep those animals that do not test positively alive and hope that they do not subsequently go down with the disease and in many cases they do not go down with the disease. That has always been at the bottom of my problem with a culling strategy even though I think it is terribly unfair that we cull cattle and do not cull badgers, there is a disparity there. As with human beings the only way to overcome this blessed disease is eventually when you get herd immunity, and in our case it was a vaccination strategy and it was built up over time until thankfully in the developed world at least TB is no longer a killer. How do you sort of put into economics that sort of nature? The Chairman is always going about invest to save, if we were to go now and say, “Look, we’re not waiting ten years for this vaccine. Even if it’s not the most effective vaccine at the moment there could be some logic in trying a vaccination programme for both cattle and badgers” (we may see this tomorrow at Weybridge) and put some economics behind that to say that this is a sensible way forward rather than the policy of fatalism or the politics of pure culling, you know, just hope that the culling turns the corner for the rate of increase in the incidence.

Professor McInerney: The question you ask is actually an impossible one because there is no economic answer to anything without the underlying technical data. All economic analysis says is that if you are going to do this, is it worth it? Coming back to your question, one has to ask: What is the likely time span for getting the vaccine? What is the likely effect of a vaccine on reducing the TB breakdowns as compared to any other measure? Then I would come along and do an economic analysis to see whether that is a better approach than any of the others. All economic analysis does is that it puts all the options up and ranks them according to which would seem to be more worthwhile. Clearly with the vaccine, once you have got it, it would seem to be a pretty cheap, repetitive control measure to use. You write off I guess all the development costs at some stage and then we end up with probably quite an inexpensive and well-worthwhile control measure, but we have not invested enough to have got the vaccine. I was on the Dunnet committee 20 years ago and the interim strategy was proposed because we were convinced that if we throw enough money at it we would get a trap side test for badgers, you will get a live test and you can trap the badgers, kill the infected ones and you are away. The whole interim strategy was based on that premise which was a false scientific premise in the event, because the

live test was not as possible as the scientists told us it was. We come back to this problem with a vaccine. In a fairly straightforward sense a vaccine policy would seem to be the best one if you can get it to work.

Q535 Chairman: What you have is a situation where the budget that Defra currently spend is about £90 million a year against the background where their departmental budget is under pressure. They have already introduced an economy measure with the compensation tabular method of valuing the cattle that have to be slaughtered and yet out there, particularly in the hot hotspot areas, dairy farmers are in a state of despair, their businesses can be catastrophically changed as a result of the incidence of this disease and so far apart from a couple of leaflets and a bit of knowledge being spread around I can see they think that there is nothing very much happening. The alternative is to get in there and do a bit of culling; at least do something about it, get rid of some of these badgers. The other alternative is to say that if we have a vaccine how much more money sensibly would advance that? We do not seem to have an answer to that question. Secondly, how much should we invest in provable biosecurity measures? We might have an answer to that once somebody finds methods that could occur but so far nobody has come along and said that if we have some money in a pot to encourage farmers to do all the things that are recommending, get the things going. We do not have that bit either. All we have are the politics of trying to reduce the cost or possibly sanction the ultimate cheap way out of it which would be to let the farmers go out and blast away. That gets the problem off our back and the farmers feel better because they are killing a few badgers and we will just carry on with the vaccine work. If you were sitting there and you had all this whizzing round and you had to give a piece of advice to ministers about how to optimise the expenditure which they have at their disposal, you seem to be suggesting that it is better to go down speeding up the vaccine route, possibly put a bit more into biosecurity, maybe there are other things, but where do we get the biggest bang for our buck at the moment if we are actually going to get on top of this thing?

Professor McInerney: You are asking me empirical questions I fear for which there is no data. As an academic I do not give opinions but as a small farmer in a hotspot area surrounded by TB I feel very strongly about what you said about what is happening to these guys. The evidence that came out of all the ISG’s work is that you get more bang for your buck by pursuing the prospects of better control via cattle control measures. Keep going with the vaccine because in the longer term, as an act of faith, there is a prospect there.

Q536 Dr Strang: But that is all it is.

Professor McInerney: It is an act of faith because you do not know when the answer will come. It is a bit like oil exploration, you go on hoping that you are using all the right principles and you find it

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eventually. It was ten years for a vaccine when we started and it is still ten years for a vaccine and that is a real dilemma. The economic analysis of culling seems to suggest to me that if Defra has some money to spend it is not going to spend it in the interests of the economy particularly by trying to solve TB by culling badgers. There are two questions here: What is the best thing for Defra to do with its money? What is the best thing for the total economy, which are all the people involved? Interestingly and paradoxically, if Defra were very cynical about it—using the data on the costs of badger culling—a large proportion of the benefits of breakdown reduction from the effect that that has accrued to Defra and not to farmers. In a way it is not worth farmers spending what they would have to spend on culling because the farmer licensing culling programme would save Defra a hell of a lot of money and farmers would soon say, “Hang about, we are spending a lot of money here, it is not coming home” and that is the farmers who are doing the culling. As Chris Cheeseman was saying, for every 12 farmers who avoid a breakdown there are ten who experience one. From a policy point of view I think it is very difficult—perhaps impossible—to say that a farmer with a closed herd, who has had a closed herd for years, has not brought any cattle in, has a breakdown for the first time in 15 years, it can only be due to the badgers on his farm and you have to

say to him, “Okay, I know where you got the disease from but you cannot do anything about your badgers”. That is a case where I think in political terms there are beneficiaries who are all the cattle farmers and there is one guy who carries the cost. Either the industry should share that cost or the state should rather than expecting individuals to carry the cost of the national policy because the national policy means those who are directly affected should not do anything about their badgers unless they can hermetically seal their farms. There is a real difficult problem there. I think that is a political one and not an economic one; it is an equity issue about what is it fair for who to pay what as opposed to an efficiency issue which is: what is it worth doing overall?

Chairman: As an economist that is a very elegant way to bring your evidence to a conclusion because it puts you very much on firm home ground as an economist. Thank you very much indeed for giving us a lot of interesting food for thought. We shall reflect very carefully on what you and the other witnesses have said, so thank you very much for your patience, all of you, for being here this afternoon and helping us. We are going to the VLA tomorrow at Weybridge so we shall learn more about some of the answers to the unanswered questions on vaccines and at some point we are going to have to write a report, so thank you all very much for your contributions.

Monday 10 December 2007

Members present:

Mr Michael Jack, in the Chair

Mr Geoffrey Cox
Mr David Drew

Dr Gavin Strang
Paddy Tipping

Witness: **Lord Rooker**, a Member of the House of Lords, Minister for Sustainable Food, Farming and Animal Health, Department for Environment, Food and Rural Affairs, gave evidence.

Q537 Chairman: May I welcome to the Committee Lord Rooker, an old friend of our inquiries. He is the Minister for Sustainable Food, Farming and Animal Health. I know he has taken a particular interest in this inquiry, coming to some of our earlier evidence sessions. Minister, we are very grateful to you for the fact that you have followed closely the work of the Committee in this respect. I wonder if we could just try and put a little perspective onto the present state of matters connected with bovine TB and particularly the amount of money that the disease is currently costing the government. In chapter four of the document published in February 2004, entitled “*Preparing for a New GB Strategy on Bovine TB*” on page 23, your department published a projection indicating that by 2012/13 the disease could well be costing an annual expenditure of some £300 million. Does that number still remain the long term projection for Defra of the costs of bovine TB?

Lord Rooker: I would imagine that is the state of play because not a lot of work has been done. There were recommendations from the ISG as well which would cost a lot. It pre-ordains the fact that you have a policy to operate. That figure would have been produced on the basis probably of maybe the current situation, the current spread, but things change of course, levels of compensation, levels of research. Nevertheless, it is costing a fortune. It is the best part of £100 million a year now. It takes up 40% of the Animal Health Agency’s resources and it is growing. The disease is spreading. I would not argue about the figure that was projected quite a while ago for some time in front of us. It is a serious issue and it is costing a lot and it is going up.

Q538 Chairman: Given the fact that interestingly this document did predict with some accuracy that the current figure is the one you have just given to the Committee, I think we can safely assume that unless something changes policy-wise that is the order of magnitude of public expenditure on this. You have made it very clear that you are not going to make a final decision on this matter certainly until this Committee’s report has been produced, but I think it would be helpful for the Committee to know, once our report which will be amongst many pieces of information that you will have before you has been produced, what is going to be your methodology in coming to a conclusion on this matter? Are you going to simply make a decision on the question of whether to cull or not to cull or are you going to

ultimately, in your response, produce a more comprehensive, updated strategy to deal with bovine TB?

Lord Rooker: It has to be the latter. Obviously I will answer your question but I have not come here to spend all afternoon on culling or not culling. The issue is bovine TB. We have a serious disease in a food production animal. There is a reservoir of it in the wildlife. It is growing and everything we seem to do is not constraining it at the present time. There are all kinds of economic ramifications, let alone the animal welfare ramifications both for food animals and wildlife. Therefore, we have to come to an arrangement, after the Committee has reported, to make a decision. There is an imperative to this. I have not followed all of the Committee’s evidence but there is an imperative because there is legislation on the statute book that allows licences to be issued for disease control, part of which says at section ten, paragraph nine, that the licences shall not unreasonably be withheld. We have to have a reason if the answer is no. There are applications being prepared based, believe it or not, on the ISG report—i.e., prolonged, regular culling over larger areas could actually reduce the disease in those areas. The ISG do not believe the farmers could organise it and that is the other issue. We have to come to a decision in the round. It cannot be a decision to cull or not to cull because the legislation, unlike for other wildlife, is different. There are applications there and we cannot simply say we do not want to know about it because we will be up for judicial review if we do not do anything about it. The ISG has performed a valuable role. I was there right at the beginning ten and a half years ago, having received the Krebs report initially in 1997. As ministers, we have to take advice in the round from the economic side, the trade side and the vets. Vets never get mentioned in this. The Animal Health Agency is out in the field. I have been to their local offices. I have seen the paperwork involved. I know why it costs so much, by the way, and I can show you the paperwork trail. It costs a fortune. The computer system is out of date. It has black and white screens. I have not seen those for years. There is a massive paperwork trail both for the testing and also the checking and the tracing. Administratively, it is a nightmare. It is almost a paper-based system although there are obviously computers used. We have to take a decision in the round based on the ISG, based on the scientists. Defra has its own scientists, sometimes much maligned, and scientific advisers. We have to take a decision in the round,

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taking into account the constraints we have of legislation that is there, that can be activated by citizens.

Q539 Chairman: You mentioned a number of sources of advice and you specifically underscored the importance of some of the quality of the advice that you can receive from within government. To date, have any of the bodies that report either to you directly or to Defra as a collective made a recommendation that culling would be an effective form of control of bovine TB?

Lord Rooker: In the package of documents that I think you have received along with the report that Sir David King did, I think the Committee also had letters from the Defra family of the Animal Health Agency, the VLA, the CSL and Natural England. If you read the letter from the chief executive of the Animal Health Agency, she makes it abundantly clear that whilst there is a reservoir in the wildlife they are in real trouble. They cannot do anything about the situation. I can quote it if need be. This is a letter dated 26 July. The letter from the VLA makes it clear that whilst there is a reservoir in the wildlife it would be virtually impossible to eradicate it in cattle. They were commenting on the ISG report, by the way. We asked them for their views and this was done in a series of answers to particular questions. From that point of view, particularly in the West Country where 70% of the breakdowns are attributed to badger to cattle transmission according to the Animal Health Agency, we have a serious issue on our hands. I am not saying they are all saying the same thing. Natural England has its view and CSL of course is slightly divorced because of the research it is doing. That is very useful information but you ask me have any of the agencies said that culling would help. The Animal Health Agency makes it clear we cannot do much if we do not do anything in terms of attacking the wildlife reservoir. Anyway, they are on the front line. That is where we are spending all the money.

Q540 Chairman: You are quite right in saying that you have to tackle the wildlife reservoir but, as you have mentioned the papers, I too shall mention them. I could not find a clear recommendation in any of those papers from your advisory bodies to say that culling was the answer. They did point to many other elements of a strategy but it sounded to me as if they were unclear about culling. They also indicated that there were large areas of knowledge which you still do not have a clear answer on—for example, the way in which the disease was transmitted. Perhaps you could tell us about where you think the holes are in terms of your department's personal knowledge in understanding how this disease operates.

Lord Rooker: You asked me a question about their recommendations. All their views on the ISG were predicated on the basis that there was no single action to deal with this issue. They all raised the issue of cattle movements. In the letter from the Animal Health Agency, as indeed from the VLA information, the nature of the cattle to cattle spread is not quite as generally supposed. The molecular

structure of the TB in the areas with cattle and badgers in, say, Cornwall is unique to Cornwall and there is another one that is unique to the Gloucester area. In other words, if it was cattle moving all around the country, there would be a more uniform molecular structure across the country. In terms of what we do not know, you do not have to look any further than page 173 of the ISG report, paragraph 10.49. It is replete with "it is not known whether", "it is unclear", "the lack of information". There is an awful lot we do not know. Five or ten years ago when this started, we were assured by the scientists that they would be able to explain transmission. The original plan was to do this over a five-year period, although I think the five became seven. The seven became ten because of foot and mouth. If we did this work, we would know within this period of time what the method of transmission was, if presumably there was a method of transmission—Krebs had made it clear there was a big connection; that is why we went ahead with it—but we do not know that. What we do know is that there is a correlation in the reservoir in wildlife with bovine TB in cattle.

Q541 Chairman: The reason I asked you that question—I am glad to hear you confirm that because it is still an area of evolving science—was to know, when you have to sit down in the new year and make your decision, how comfortable you are that there are still quite large areas of knowledge that are incomplete. These papers make it very clear that here you have a disease but you do not know for example all that there is to know about the way it is spread. These papers make it clear that in terms of workable biosecurity solutions there is still a lot of lack of knowledge. The papers make it clear that in terms of vaccination that we will come on to talk about in more detail there is still a lot more work to be done. The papers also make it clear that culling is not, in the judgment of these authors, the silver bullet solution. Given all those unknowns, are you comfortable that you will still have at some stage in January or February a sufficiently robust body of opinion to be able to make a decision that you will feel comfortable with that is not going to end up being challenged?

Lord Rooker: That is the point. If we do not make a decision, the way the law stands at the moment, we could end up by being challenged by those who want to push us. We would be held to be unreasonably withholding licences because we do not have a reason. I sat here whilst David King and John Bourne gave their views. They were not arguing about science. They were arguing about the application of culling. The ISG makes it quite clear they do not trust the practicalities and the economics if the farming industry was to do a large, sustained cull over wider areas, the 300 square kilometres as opposed to the 100 square kilometres. That was what was predicated. There is no evidence in the report as to why the farmers could not organise it, or on the economics. But the ISG made clear that was their opinion, that it could not be done, but if it was done it would assist in attacking the disease. That point is made clear. There are also issues relating to

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cattle movement controls—it is still too early in some ways to get the results of the changes we have made to controls on cattle movements. And there are other ISG recommendations which we have not fully costed—which would cost tens of millions of pounds we do not have. We have to take a decision in the round to operate on more than one front. At the moment the routine testing and slaughter is the baseline of the policy. That is what happens. That costs a fortune.

Q542 Chairman: Your argument so far in front of the Committee is predicated on the grounds that challenge will come, for example if you were to say no to culling, from those who want to cull. I am equally interested in whether you feel confident that you have a body of knowledge to defend the decision that went in the opposite direction where, if you did decide to come down in favour of culling and you were challenged, you would have sufficient knowledge to be able to defend such a decision.

Lord Rooker: It is a bit difficult when in this case the science is not clear-cut and you have different scientists, all eminent in their fields and in each other's fields, maybe agreeing to the science but agreeing to different conclusions from a practical point of view. The buck stops here. That is not the issue. We are not leaving it to the scientists to decide the policy. The policy has to be decided by ministers inside government. The point is the present situation is unsustainable. The cost is unsustainable. We cannot tolerate the costs that we are spending, from the taxpayers' point of view, on this. This is a warning to all that things have to change. No decisions have been taken. Ministers have had discussions although obviously there is a different team now to what was there before the summer. If there is a decision taken, it has to be taken in the light of the constraint that we have from the legislation and with a queue of applications for licences. If you are going to take issue and say no, under no circumstances do we issue any licences, it therefore makes you wonder why the legislation is there. It is there I am also informed by officials in case rabies ever comes into the population. Legislation was there to protect the badger before we found out about TB in badgers so it was never put there for that reason. It was put there for another reason altogether. We have to take the decision in the round. Nothing is perfect here but there is enough evidence from the science. From a practical point of view, we are not going to pay for anything. The government will not be paying for any action to operate licences other than the supervision, setting up and monitoring. If we went down that road, we would not be employing teams like we did during the trials. It is made quite clear in the ISG report that culling as practised by the culling trial does not work. There is a conclusion here. We found out that it does not work in small areas where you are only culling eight nights a year, maybe only four, five or six years out of ten. It does not do the job. The implication is, done another way, it might. There are scientists who take the view that it could and if the industry took that view they would have to pay for

it. One cannot be absolutely sure about this. And there are the other economic implications of the disease for industry as well in terms of trade and the spread of the disease. The disease is spreading. What is our policy? If you are asking me: is our policy to eradicate bovine TB, I cannot say yes to that. We do not have a policy in that respect. Are we trying to control it, stop it spreading, close it down in the hotspot areas? Until we can get a decision one way or another on what we seek to do with the wildlife, it makes it impossible for us to talk to industry and anyone else about the wider policy.

Q543 Chairman: You have just given us a shopping list of things you would like to do. What do you want to do? Do you want to control it, stop it, deal with the hotspots? You must at this stage have an idea of what you want to do. That is why I asked you. I said, "When you come to make your decision, are you going to come out with a complete policy?" You indicated of course you have to have all the elements together. What is going to be the aim of the policy with all the elements together that you are going to announce? Could you give us whichever of those items on the shopping list will be covered by it?

Lord Rooker: Quite clearly, eradicating bovine TB would be quite helpful. However, from a practical point of view as all the papers make clear, eradicating bovine TB in cattle whilst it is present in wildlife is impossible. Therefore, the question is can you control it, cut it back and stop it spreading. That is number one. That has to be a practical starting point. One has to be practical about this. Most of the rest of mainland Europe have done it with the testing policy, but they do not have an issue with the wildlife. There is more disease on the boundaries of Europe, but we have it in the wildlife. As the evidence makes clear, you have to take other action if you are not doing anything about the wildlife. The fact is, if it is eradication you are going for, you will not do it. Therefore, we have to stop the spread. So far, we have not stopped the geographical spread in the last ten years. Obviously the hotspots have become worse but geographically the spread has become quite serious and is getting worse. That has to be an objective: to cut it in the hotspots and stop it spreading geographically. That has to be a number one priority. How do you go about that if you ignore it in the wildlife? There are things you can do but will they be effective from a cost point of view? Someone has to pay for this and the taxpayer is not going to pay for it all. I have to make that abundantly clear to the Committee and the industry. The taxpayer has come to the end of the line in funding at this scale so we have to take action in other directions.

Q544 Dr Strang: We will come later to the taxpayer point but I think the Committee will be in agreement with what you have said. The science has turned out to be much more complex than I reckon was envisaged at the start of the whole Krebs process. It is a very complex disease. It seems to me that you are saying, when you announce a new policy, this will probably include a package of measures. It will not just be one thing directed at the very important

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reservoir and the badger population issue. I want to ask you about the actual spread. When you look at what has happened—okay, the costs are £90 million on the testing and compensation and £20 million to the industry—there is no dispute about the enormity of this issue and the need to see if we can produce a range of policies, not just the one, which can begin to turn it round. Much as I accept that we have to concentrate on the hotspot issue and the badger reservoir, do you not think we could look more rigorously at this question of the movement in the non-hotspot areas to see if there is a case. Rather than just looking at the hotspots and saying, “We have to deal with these because they are urgent” and the farmers feel that way, we also should be trying to take action to stop it moving to other parts of the country in significant numbers because, as you rightly say, the costs are unacceptable.

Lord Rooker: With respect, I am not sure what the question is other than how we can stop it going on. Stopping trade in cattle and movement is one thing. We have pre-movement testing now and might have in the future post-movement testing. The farmers are paying for that [pre-movement testing]. A good deal of the TB that has arisen in the northern part of the country, I am told, has come about because of trade but generally speaking, if you look at where the hotspots are in the south west and the southern Midlands and Wales, the hotspot areas themselves have been growing, not necessarily all as a result of trade. The Veterinary Laboratories Agency and the Animal Health Agency have made the point that the type of TB in cattle and badgers is unique to different areas of the country. You can distinguish it. If the issue was all about cattle movements, it would not be identified as different molecular strains in different parts of the country; it would be more uniform across the country. In other words, they are making it quite clear that the correlation in different areas of the type of TB is unique to that area, both the cattle and the wildlife. While we have to do things with movements within the areas of the hotspots, as you know there are areas in the hotspots where there have been no breakdowns. It is very difficult to explain. That is what makes it so complex. There is no easy answer to this. You are quite right in terms of the movements but trade is bad enough anyway. At any time, you have 4% of the herds, slaughtering over 20,000 cattle a year, restricted from trade and you cannot use the milk from reactors. The costs I have given are taxpayer costs and the costs to the farming industry are horrendous, both emotionally as well as financially. I am not devaluing that at all. The costs of this disease to the industry are already very substantial. It is very frustrating for farmers and the industry but it is much easier for the government to be able to measure the taxpayers' costs. You are absolutely right. There is no magic solution to this, whether it is controlling movements, restraining trade, zoning the country or cordon sanitaires which we discussed back in 1998 around parts of the country, so no cattle were allowed to move in and out, but of course that would destroy our cattle industry because of the nature of what happens in different parts of our land.

Q545 Dr Strang: When you were saying that you knew where the money was going and that is taxpayers' money, I was not quite clear what you were saying. We know the costs of the compensation but when it comes to the control measures, the reactors etc, I was not quite sure whether you were saying we have a ramshackle, inefficient policy in relation to the testing and monitoring of the movement of the cattle and that that is something which is not working satisfactorily or that it is not being an adequate use of these resources. Is that what you are saying?

Lord Rooker: No. It is not a modern system. It is an incredibly complicated system. 40% of the resources of the Animal Health Agency, on average, are on bovine TB. It is our most serious disease. Foot and Mouth Disease is important. Blue tongue is important. Avian influenza is important. Bovine TB is much more important in terms of costs and resources to Defra over a period of a year than any of those other diseases. We have learned to live with it in that sense. We have come to the point now where it is getting so expensive that we are going to have to say, hang on, we cannot carry on like this. The system has not been modernised because everyone is waiting for a [badger] policy. If you go to an Animal Health office and ask to see the paperwork flow and the systems that they use, they have not been modernised. I have given you an average figure of 40% of resources. In the south west and the southern Midlands, it will be 70 to 80% of the Animal Health office there that are devoted to bovine TB. It is not a national disease in this sense. It is highly regionalised, as you are well aware from your constituency experiences.

Q546 Dr Strang: This brings us right into the proposed levy. Obviously, the session is not just going to be on the levy which is very controversial but is this levy going to apply across the board in GB? Is it envisaged to apply in England, Scotland and Wales or is this an England only levy?

Lord Rooker: Levy is a shorthand and it is not a word that I have used. The cost and responsibility sharing document for a long consultation should hopefully be published before Christmas. One can never be certain as a minister when things are going to be published but it is due to be published before the break. It is not a policy but a series of questions. I visited Cardiff, Edinburgh and Belfast to discuss this during recent months. I get a very personal welcome but everybody wishes I was not in the room when I am there with the ministers and the farming unions in all three of those countries. We would like it to be UK wide. If it is not, we will get something forced on us by Europe anyway so this is not an issue where we can say, “Go away”. On the question of who it applies to, it is talking in terms of disease control. The document will go quite wide because a third of the crops we grow feed our animals. If that is the case, I do not see why the people who grow the animal feed should not be involved in these kinds of arrangements as well.

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Q547 Dr Strang: Are you saying that the European Union will seek to try and implement a policy?

Lord Rooker: Yes indeed. There is a proposal coming down the tracks from Brussels for cost and responsibility sharing in animal disease. If we do not in the UK have some consensus of our own, when it gets to Brussels and we are sitting there with nothing, the chances are because various countries in Europe already do something—Spain does something to a greater or lesser extent; France, the Republic of Ireland and Germany and Holland, I believe, to a greater or lesser extent—they all have policies they are using. They will build their policies into the Euro policy, maybe none of which suits us. If we have nothing to put on the table, we could end up with something dumped on us that is completely anathema to the whole of our industry. There is a good reason why we should try to build a consensus within the UK about cost and responsibility sharing for animal disease on those grounds alone, let alone trying to share more of the cost. We have to be prepared as a government to share some of the responsibility.

Q548 Dr Strang: As I understand it, what is envisaged—and this is not meant to be a criticism necessarily—is that sheep producers in the north of England would be paying the levy which would be used for animal diseases across the whole of England. It could be used for brucellosis or whatever.

Lord Rooker: No, it is not like that. The paper is not that prescriptive. It is done with consultation and lots of questions. I will take a roadshow along with officials around the country to discuss it with the industry. It is not a policy paper. It is a paper to have discussions about building a policy. Unless I have something written down as a document, frankly no one will talk to me about cost and responsibility sharing. Therefore, we could have this paper and a long consultation—16 or 14 weeks—well above the normal 12 weeks anyway, and then we will go away, think about it and then come back hopefully with a consensual policy and then consult on that. Nothing is going to be rushed about this but we have to make a start on it. There is never a good time to make a start. We were told that it was planned to be in September and for various reasons it did not occur, but the intention is to publish a discussion document before the Christmas recess.

Q549 Mr Drew: Was it a mistake, with the benefit of hindsight, to get the chief scientist as was to launch his own inquiry into this and not even tell the Independent Scientific Group what was going on?

Lord Rooker: No. You talk about the chief scientist as was. Sir David King has not quite gone yet.

Q550 Mr Drew: Soon to be no more?

Lord Rooker: He is coming to the end of his term in the normal course of events. No, of course it was not. We had this report that had been in gestation since 1998 when the ISG was set up, when Jack Cunningham was Minister and I was the Minister of State. It has taken a long time. Various bits have

been shared with us. A lot has been published over the years. We knew there was a large tome coming. The pressure from the industry and everybody else on us about what are you going to do and what is your policy going to be when it was quite clearly on hold. We had issued no licences, other than very exceptional circumstance licences. People were beginning to think about that because the legislation is there. We had asked this group to do this job and we needed to know ourselves about this. We have our own scientific adviser. One has just retired. We have a new one now, part of the Nobel Prize winning team. Both are quality people. We have the vets inside Defra. We have our own agencies. We are very much a science-based Ministry, more science-based I think than any other Ministry other than Defence. It was natural that ministers discussed these issues. Ben was the day Minister on this job but I was the Lords Minister and sat in on as many meetings as I could with both Ben and David on this before the reshuffle. It made common sense that we had a government chief scientific adviser with a team to say—

Q551 Mr Drew: Why did you not to tell the ISG that this was going on?

Lord Rooker: At the time we asked David King to do this, we did not have the ISG report.

Q552 Mr Drew: The ISG did not know that David King was going to look at their findings until he produced his report?

Lord Rooker: Yes, but we asked him as ministers. He is the government's chief scientific adviser. He is not the ISG's compadre in that sense. No discourtesy was intended but they did not need to know. It did not affect their report. It would not have affected their report anyway. We did not have their report at the time he was asked, as is made clear in the letter he sent you subsequently. We asked him to run over this and he did this with a team he put together. We did not tell him who to talk to. We asked our own family—the Defra science based agencies and the vets out in the field, much maligned, but nevertheless they have some experience to share with us—to do this. You have seen all the dates on the letters. They all came in right at the end of July/early August just as foot and mouth hit us and that was a priority. Bovine TB is more important and damaging financially but the emergency of foot and mouth was crucial. It was all hands on deck. Therefore, we parked that. A new team of ministers had arrived and it was simply parked. There was no ulterior motive in that at all. The issue that we discussed before the Sir David King report was published was that the report of him and his colleagues who had looked at this ought to be in the public domain. All right, it was done very much at the last minute and that is to be regretted but it has not altered the science. It does not alter the practicalities of what is said in terms of recommendations. It happens probably every week that government ministers ask the Chief Scientist for advice on various things that are happening. To be honest, I am looking for as much advice as possible on the issue of bovine TB

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and Hilary will be the same, not just on culling. We want the economists to talk to us. We needed the vets to talk to us and we need the scientists to talk to us. The scientists do not speak with one voice. The science is there. It is the conclusions and recommendations which differ.

Q553 Chairman: You have given us another shopping list of all the people you want to talk to.

Lord Rooker: That is right.

Q554 Chairman: What I am interested in is to know who you have been talking to up to now. It is almost as if these people have been silent and yet they have not. You have had an absolute ocean of advice from everybody on this particular subject so when you say you want all these people to come and talk to you can you be a bit more specific about what you are going to talk to them about? What is going to be on the shopping list of knowledge?

Lord Rooker: Do not misunderstand me. What I'm trying to say is that, as ministers, we have to reach a conclusion. We want to take in as wide a range of opinions as possible. We have loads of opinions. It is not a question of going back to people. We have an awful lot now. Your Committee started an inquiry, quite rightly, on the report. We took a view that if the select committee was going to have an inquiry on this, which would be quite useful because you take external evidence as well, we have our own forays which we have made clear—you have the documents; we have not hidden anything from you in that respect—we have a new team of ministers anyway and a new Secretary of State who will want to listen to a lot of voices. He has not had an opportunity with the flooding and foot and mouth to listen face to face to some of the groups, scientists, the wildlife groups and others as I have had over the years or as Ben has had over the years. We are not going to start a new inquiry. We would welcome your report as a key input into the decision-making process. We need to get on with this.

Q555 Chairman: Let us say we report some time in the middle of January. What is your timetable from there on in terms of coming to a conclusion? What is the methodology that you are actually going to use to hear these voices? Are you going to postulate a series of policy options and ask for opinions?

Lord Rooker: We have done that.

Mr Cox: 2006, three months.

Q556 Chairman: You have a series of policy options?

Lord Rooker: We have a series of policy proposals from the ISG which we have to look at costing because they were not costed.

Q557 Chairman: Those are the ISG's. I am talking about your agenda. In other words, you said a little while ago, "We are going to have to talk to all of these people", so you are going to have to talk to them about something which will be the sum total of the body of knowledge which I guess exists at the present time, but you are going to have to formulate that in terms of the questions you are going to be

asking these people in the light of all the knowledge that has accumulated over time. What are you going to be asking them?

Lord Rooker: First of all, in order to be able to discuss with the cattle industry and everybody associated with it about what we do about bovine TB, they are going to come back to us and say, "Are you going to let us deal with the wildlife?" If the answer to that is no, then you have a different debate as to whether the answer is yes under a licensed procedure. The starting point comes into will you issue licenses or do you put the barriers so high—

Q558 Chairman: You said, "Are we going to deal with the wildlife?" When it comes to all the people who are advising Defra, all of the scientists, the vets, and the people that you can draw on, are you first of all going to say to them, "Right, here is the body of knowledge. We as ministers want to know, yes or no, do we start with dealing with the wildlife reservoir?" Is that going to be your first question?

Lord Rooker: It is a question that we will have to answer. I am not sure if it is the first one, but it has to be answered.

Q559 Chairman: What will be the first question?

Lord Rooker: First of all, if you take the issues I have mentioned in terms of controlling, stopping the spread or go for the ultimate, do we have a medium to long term idea of eradicating bovine TB in this country? If that becomes a policy objective for the long term, a set of policies flows from that.

Q560 Chairman: I am still struggling to understand.

Lord Rooker: I am not saying that that is the objective.

Q561 Chairman: I want to know what are the questions that you are going to be asking for answers to. Which is going to be at the top of the list? We have all reported. You have all the body of knowledge. Now you have to sit down and distil out what the policy is going to be. Where are you going to start? What is going to be the first issue which you as ministers are going to want to resolve to decide the internal Defra road map towards a conclusion?

Lord Rooker: This is somewhat below the belt but the first decision is probably that we are not paying for it. Once we make a decision that we, the government, are not paying for this, we are paying so far—

Q562 Chairman: Does that mean the end of compensation?

Lord Rooker: No, I did not say that. What I said was a set of new policy options start to cost money. We have reached a limit. We are not going back to the Treasury. We have no plans to do that. The Defra budget is under severe pressure, as you know from the Permanent Secretary. The cost and responsibility sharing debate will start in serious earnest once we have published our discussion paper because this is part of it, although it runs in parallel to the TB policy considerations at the same time. If you start looking at costs or put figures on some of

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the costs of the options, whether it be vaccines, greater use of the gamma interferon test and other things like that, and you start to say, “Hang on, we have reached the point where we are not going to have any more money”—we may spend less than we are at the moment, by the way—but no decisions have been taken. I do not want anyone to misread what I am saying. The status quo is not an option. If you start off with the premise of that, you can then talk to industry. Someone is going to have to pay for this, if we are not, if action is going to be taken. That predicates part of the policy arrangement. That is not to say it is more important or less important than saying, “Do we deal with the wildlife?” We have abundant knowledge from the scientists but if we do not do anything with the wildlife we cannot eradicate bovine TB. That is axiomatic. This view flows from the vets, from the Animal Health Agency, the VLA and the ISG. The ISG’s view is you cannot do it the other way because the practicalities are such that the farmers are not organised enough to do it; the industry is not organised. It would be too expensive for what you get back as a gain. Until you do the sums on the cattle measures—because they have not been done—you do not know. You need to have discussions with those who are going to operate the policy and pay for it before you can reach a consensus on what is a very serious, complex issue. I am sorry but it is not possible to say what is the top one. If you start off with the premise that we are not paying any more for this—indeed, we may pay a lot less for bovine TB—therefore, what do we do? Who is going to pay and what are the actions?

Q563 Dr Strang: Were you satisfied with the ISG’s cost benefit analysis of badger culling?

Lord Rooker: The cost benefit analysis basically was using Defra work anyway and they did not do any cost benefit analysis on their recommendations on cattle movements and everything, as far as I know. We have to do that. We have not done that.

Q564 Dr Strang: Will the department be doing some cost benefit analysis in relation to cattle based policies?

Lord Rooker: We have not done any work on that at the present time.

Q565 Chairman: You have done no cost benefit analysis?

Lord Rooker: Not on the recommendations of that report. We know from officials it will cost tens of millions. We have not set a team up to go to work on this at the present time.

Q566 Chairman: Are you going to do that once all the information is in?

Lord Rooker: We will have to have a look at that, to be honest, because someone is going to have to pay for it. I repeat: the money is a key issue because it dictates where the policy goes. The implications of some of this are, for example—to go beyond the current 50,000 gamma interferon tests, we would find a lot more reactors than before which means a lot more compensation. That in itself would put our

moneys through the roof. We do not have it. Therefore, that is not a starter. It already costs £1 million more or less before the compensation is paid. If you start down that route, we are committing ourselves to more public expenditure and we have no change in policy. We have no package, if you see what I mean, so we are not going to go down that route. We have to be very careful about the way we do it. That may be unsatisfactory but it is the best you are going to get on the money.

Q567 Paddy Tipping: I wanted to pursue the money bit. It is clearly the case, as you have told us, that Defra’s budget is in real financial difficulty and that savings have to be made across the board. As I understand it, what you are saying is that one of the ways of reducing spending—this was the point with Gavin Strang—is to cost share presumably around compensation.

Lord Rooker: Yes. I got this everywhere I went, more so in Cardiff rather than in Scotland because it is not a major issue there and Northern Ireland is slightly different. I get this at every meeting I go to in England, wherever I am, without exception, when the issue of cost and responsibility sharing is raised. Someone will say, “By the way, are you going to share responsibility about the wildlife reservoir?” Therefore, in some ways, if a decision is made in principle not to operate the Badger Protection Act licensing and we say so, another set of policy options flows. If we say we will operate it with licences, a different set of policy options will flow. We can only look at that once we have made that decision. We have not made that decision yet. That decision has not been made by the Secretary of State or ministers. I do not say we have not discussed it. Of course we have, with the ISG report and before the ISG. It is not clear cut on the science. In some ways that is not very helpful to us. Therefore, it is our decision to make. Whichever way we go, we will be in trouble with one group or another. We realise that. The buck stops here. Once that decision is made, do we do anything at all about the wildlife or do we simply say, “No, it is more cattle restrictions in terms of separating wildlife and cattle”, which is virtually impossible in many areas. In sheds you can do it but you cannot do much in the fields. Movements, more restriction on trading—if you take that decision, a set of policy options will flow. If we then take the decision, well no, the Act is there; we can issue licences; it is conformity with the law; Parliament expects us to issue a licence if disease is prevalent and do something about it, does the science justify it? One group of people will say yes; the other group will say no. They can pick the bit they want from the science. Take a bigger area. Change the policy. In other words, if we make that principal decision, should we ignore the wildlife reservoir? That is a fairly important decision to make and other things will flow from that. We have not made that decision yet.

Q568 Paddy Tipping: I am just keen to focus on your desire to reduce the budget and you have made that crystal clear.

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Lord Rooker: I am not going to let it grow anyway. It has to be reduced.

Q569 Paddy Tipping: One way is to cost share. In crude, political terms, is there not a trade off between saying to farmers and land owners, “Yes, you have to cost share but we are going to have a cull”? That is a straight trade off and you are going to do the cull.

Lord Rooker: It would be crude and the wrong way to approach it. I do not think that would be fair to the industry and I do not think it would be a legal way, to simply say, “We will chop your compensation and, by the way, as a *quid pro quo*, you can go culling.” That would not be legal and I do not think that would be anything I would recommend to the Secretary of State. You have to be more targeted about the cost sharing around the country. Once you have made that principal decision about whether you are going to touch the wildlife or not, I do not think we are going to sell culling as a way of cost and responsibility sharing. I think it would be quite wrong to do that. Others who will want to take a crude view, looking at black and white headlines, might look at that but I think that would be the wrong way to approach the decision making process. I am sure it would not be done like that.

Q570 Paddy Tipping: That is helpful but let me go back to a point you made earlier on around culling. I think you made it very clear that you, the department or its agencies were not going to cull. Therefore, it has to be farmers and land owners. There is an immense cost there, is there not?

Lord Rooker: It is up to them whether they decide to take that cost. They know how not to cull—i.e., eight nights a year for a four year period—because it says in the report, “Do not do it this way. This does not work.” Therefore, there are other opportunities and other ways of doing it. What it clearly indicates is more regular culling over a long period of time could make a difference in the hotspots. There are all the issues around the area, the size of the area and the licences.

Q571 Chairman: You have just commented about the ISG’s report on culling and you also indicated that decisions might have to be made in terms of licensing. In the various reports that have been produced, whether you take the Randomised Badger Culling Trial, the interpretation by Sir David King, the work that was done in Ireland, the work that has been done in various culling exercises that pre-date the ISG, there is a whole different variety of results. In terms of methodology, you can either shoot, gas or trap. There may be other methods that I am not aware of to deal with it, such as snaring. How, when you come to consider the outcome, are you going to determine what are going to be the results of these different exercises when you are going to have to think about licensing? How are you going to decide on the effectiveness of the policy that you might have to decide on and you can have a menu of options? How are you going to do that?

Lord Rooker: With respect, the scientific trial is over.

Q572 Chairman: I am talking about the real world.

Lord Rooker: The real world is not a scientific trial. The real world is ordinary, active management of the countryside. We are not talking about an experiment or a trial in which we will get results comparing one with another.

Q573 Chairman: You made a point to us. You said the taxpayers’ buck stops here and we want it to be smaller. You are going to have a certain amount of money to spend in this area and you have to decide how you are going to spend it. In terms of the efficiency of the different control measures, whether it be culling, whether it be cattle movement, whether it be biosecurity and ultimately whether it be vaccine, you have to know how effective, however they are done and by whomever they are done, these various mechanisms are. You have to make certain that if you were for example to sanction a cull it was going to be effective, properly carried out and done rigorously over time. How are you going to come to decisions on all of those parameters because surely they will be central to the decision that you might have to make about whether to licence a cull not?

Lord Rooker: That is right.

Q574 Chairman: How are you going to make the decision about it?

Lord Rooker: First of all, it would not be a free for all. Our advisers, Natural England, are our statutory advisers and deal with wildlife culls anyway. That is something they actively deal with; it is not as though this is new. There would not be a free choice. If there was a cull, the method would be pre-ordained.

Q575 Chairman: You would decide the methodology?

Lord Rooker: This would be part of the process.

Q576 Chairman: What do you mean, “This would be part of the process”?

Lord Rooker: Part of the process of issuing a licence. You would set the parameters, the amount of land involved, the commitment to doing it over a long period and on a regular basis. This is all going to cost somebody some money. We ruled out snares a long time ago. Cage trapping and shooting, and lamping, gassing has been ruled out but the work goes on in the laboratories, but the methods would be pre-ordained. The people employed to do it would not be employed by the government. We have closed the Wildlife Unit. Regrettably, they have been made redundant. There was no other option. The government would not be paying but the set of licence conditions which Natural England would apply would cover the points that you have raised and they may be—

Q577 Chairman: The point I am getting at is the effectiveness rating determines what else is going to be paid for by Defra because you said earlier you were not going, in the new world of reduced money, to abandon the testing of cattle and the slaughter.

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Lord Rooker: I did not say that.

Q578 Chairman: Would you like to make it absolutely clear?

Lord Rooker: I did not say that. I just said the routine testing and slaughter is the baseline for what happens at the moment, paid for by the government.

Q579 Chairman: That policy, in a world of culling, goes, does it?

Lord Rooker: No. I am not saying that, you are trying to put words in my mouth but you must not assume that what has gone on in the past goes on in the future. Routine testing, the one year up to the four years, and the recommendations for doing it more—if we had a recommendation to do the whole country, let us say, biannually, we do not have the resources for that and it would cost a lot of money. Frankly, that would not be part of our budget. The ISG said that routine testing and slaughter are the baseline from where they started. They have no reason not to say that because that is the status quo. We have already said that the status quo is not an option. I am not saying this will continue in the form that it is continuing now. This has to be reviewed as a policy in terms of the financial constraints and how to deal with the disease. That does not mean to say we have to carry on with what we have been doing in the past.

Q580 Mr Drew: I understand what you are saying and I think there would be unanimity for saying that what has gone on in the past cannot carry on. The problem some of us are having is that with all the investigations we have undertaken, in the short run at least, there would be an implication of higher public spending. The very nature of trying to do what you want to do, even if it is a full cull policy, means you would have to do a great deal of mapping. You would have to have proper procedures by which you could remove the wildlife reservoir. That could only be done by the state. It would be absolutely impossible to think you could abdicate that responsibility to another organisation in the short run. If you therefore take that as read, the only way you can find that money from within existing resources is if you reduce the compensation scheme and yet you are then putting yourself on a pedestal to be knocked down by those whose moneys you would wish to reduce. It would put you in a very invidious position about how you could manage this policy.

Lord Rooker: I am sorry, David. I have to disabuse you of the first part of your question. I have repeatedly said that the government will not be organising or paying for any culls if culls take place. We will not be paying for the operational mapping, the employment of the staff. The issuing of licences if it takes place will be a cost, it is true, on the taxpayer because you have to organise what you have to do in order to get a licence issued. The idea that you presuppose that this is for government, I am afraid is not correct. We are not going to do it. Because people think we, the government, is there as the backup of the last resort causes the hiatus of not

getting on with a policy to deal with bovine TB. We have reached the point where we have repeatedly said we are not going to organise a cull. We are not going to pay for one even if we sanctioned dealing with the wildlife. Industry has to deal with that. The ISG has said that they are not capable of doing it from a practical or cost benefit point of view without any evidence. If the industry has the evidence to counter that, they will know what they need to do, as long as we make it clear that government isn't going to do this. I cannot make it any clearer.

Q581 Mr Drew: Can you give me an international example of where the state with a problem—it does not even have to be bovine TB; it can be another animal disease and we could make the same arguments with avian influenza or foot and mouth and say the state has no responsibility for this—can you give me an international example where that would be the case at the moment?

Lord Rooker: No. It is very unfair to say the state has no responsibility. The whole point about this is that the state has responsibility. That is why the legislation is there in this case for issuing licences. We do not have it with the other diseases. As you know, we pay for compensation and we want to talk about this. We slaughtered some animals recently that we should never have needed to slaughter at vast public expense because of the poor biosecurity on the farms concerned. That has to be dealt with. I cannot countenance that happening again. We have to change the policy because taxpayers are paying out unnecessarily or stop, we have the responsibility.

Q582 Mr Cox: Quite a few were slaughtered because the government's Institute for Animal Health allowed foot and mouth—

Lord Rooker: I was not referring to that. I was referring to avian influenza where we slaughtered at least 50,000 turkeys that should never have needed to be slaughtered. It was poor biosecurity. That probably cost us £1 million. Because we slaughtered them compulsorily, we will have to pay for it. It was poor biosecurity and that was made abundantly clear publicly.

Q583 Dr Strang: On the possible badger culling, you have said that the government will specify the method if there is badger culling. You have ruled out snares. You have ruled out gassing. Have you ruled out shooting?

Lord Rooker: No. We have ruled out the way that gassing was done in the past. I am not saying we have a plan for gassing but it is well known that our laboratories have tested these things. They have tested some of the different types of snares as well. There is more than one kind of snare that has been ruled out. Cage trapping and shooting, and lamping were acceptable and thought to be humane. I accept the difficulty with the wildlife but we have disease in a food animal that not many people seem to want to talk about. This is quite a serious issue. It is a zoonotic disease. Not many humans get it but they can and it is spreading in animals up and down the country. We are the sick man of Europe on this issue

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along with the Republic of Ireland. To say we are abdicating responsibility simply because we say that if an action is taken on the field, on the ground, it could be done by the practitioners and the country people under licence by government, is not an abdication of responsibility by the government.

Q584 Dr Strang: Whatever the attitude in terms of it being humane or not, it does seem to be impractical. Are you saying that you are looking at the possibility of having a method of gassing which is more practical than has been suggested by some of the scientists?

Lord Rooker: No, I have no up-to-date knowledge. Gassing as done in the past is not an option, period. We have ruled out snares.

Q585 Mr Cox: Would it not be possible to envisage a situation perfectly easily where Defra approved certain types of particular contractors who might have undertaken a programme of training, who would have understood the particular parameters that Defra set, who could be gone to by land owners and farmers to carry out these culls? They would be Defra approved contractors. That would be one way of doing it. It is often done in other spheres, is it not?

Lord Rooker: That could be the way it could be done. If it was done this way in large areas, the ISG has made it quite clear, in a minimum of 264 square kilometres, 300 in round terms, it is not a massive area. It is about six by 18 miles roughly. We are not talking about counties. It can include a lot of farms on a piece of land like that. You could have well over a hundred farms. You would have to have the minimum amount of premises of land owners. Otherwise you would not have a consortium to put together. They would have to employ someone. They would have to be regulated people. We know people can do it.

Q586 Mr Cox: Would you envisage that as a single application or a number of applications bunched together?

Lord Rooker: It is a bit difficult because, with the way the law is on the issue of a licence, I think it has to go to a single person but I think that person could operate on behalf of a group. If we went down this road, licences would not be done for areas that were small or did not fit the parameters of the external boundaries. They do not have to be hard boundaries necessarily, rivers and motorways, because we do not really mind if the badgers are perturbed as long as they are not going to be perturbed towards cattle. If it is a hundred acres of arable, okay.

Q587 Chairman: Are you a hard boundary or a soft boundary man?

Lord Rooker: As long as it does not have cattle on it.

Q588 Chairman: That is the question that has been imposed in terms of the scientific findings. Sir David King softens his boundary analysis. The ISG are hard boundary men. Which boundary type do you fall into?

Lord Rooker: You have to be practical about it.

Q589 Chairman: I am asking you the question. The question was do you believe in hard boundaries and the analysis that goes with them or do you accept Sir David King's specific finding that he regards a different type of boundary as acceptable in a 300 square kilometre area? Which bit of science do you back?

Lord Rooker: If the boundary is such that the risk of cattle getting TB outside the area is diminished because they are not there, then I do not mind whether it is hard or soft.

Q590 Chairman: Who, in your assessment process, will determine the risk characteristics of the boundaries?

Lord Rooker: The licence issuer.

Q591 Chairman: Who is going to set the parameters?

Lord Rooker: The risk of perturbation—

Q592 Chairman: Natural England are going to have to decide all of these parameters, are they?

Lord Rooker: If the risk of perturbation—

Q593 Chairman: They are the licensing authority.

Lord Rooker: If the risk of perturbation is not there to cattle from badgers that have been moved around because of this, either because of a river, a motorway or two miles of arable land without any cattle on, it does not really matter whether it is hard or soft, does it? It is a shame for the badgers that have been moved out because they will still be ill if they have TB but if they are not transmitting it to cattle because they are not there, from a practical point of view, it does not matter. You have to be realistic about this.

Q594 Mr Cox: You have a note. May we hear what the note says?

Lord Rooker: It does not alter what I have said.

Q595 Chairman: You mean it is different on the note from what you have said but you think you can get away with it.

Lord Rooker: Natural England would issue the licences. We would set the framework but we would tell them the methods of culling for example. We would fix issues at the centre like the land area and the amount.

Q596 Mr Cox: This is a very familiar situation. It happens in all sorts of areas. The government sets the framework for the licensing but you would have to have published guidelines, would you not, about the nature of the boundary you would be looking for? It would be only sensible to publish guidelines so that possible or potential licence applicants could know whether they stood a reasonable chance.

Lord Rooker: Precisely.

Q597 Mr Cox: In issuing those guidelines, what sort of boundaries do you think you would be looking for in order to fulfil a condition for a licence?

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Lord Rooker: Practical ones.

Q598 Mr Cox: You have mentioned a few. You have mentioned rivers.

Lord Rooker: I have but I have mentioned those that alleviate the spread of TB outside the area you are working in due to perturbation. As long as there are no cattle around—

Q599 Mr Cox: The point is this: some boundaries will not be impermeable to badgers but they will restrict and impede them. I am told by Professor Bourne that a badger can swim the River Torridge. I would like to see it done but the point I am making is that he agreed with me when I said that not many have done it. He said probably that was true. A river for example might impede a badger but it might not, if push came to shove, stop the badger. Presumably there would be a question of judgment there, would there not?

Lord Rooker: You would look at what is the other side of the river. If there are loads of cattle grazing on the other side of the river and the risk of the badger swimming is such that we got to perturbation—

Q600 Mr Cox: In the West Country they are likely to be both sides of the river.

Lord Rooker: If on the other side of the river there is a load of arable land that is not going to be used for cattle grazing, then you have what you are looking for. The risk of perturbation and transfer—

Q601 Chairman: Help us out here. I want to get you off the hook from having to rely on bits of paper because you have had copious briefings.

Lord Rooker: I have had two so far.

Q602 Chairman: You have plenty of notes and briefings from everybody. You mentioned earlier that you had received some advice from a number of bodies, including I think Natural England, and they are the licensing body so perhaps you could let the Committee into the views that you have heard from Natural England. What do they think about the parameters for a successful culling operation? What do they think needs to be done in general terms to make it successful, effective and humane?

Lord Rooker: I do not think I can go into that, to be honest, because I am not qualified. Earlier this year we had a brief discussion with Natural England before the ISG report was published. I was not privy to the meetings because it was Ben's day job, if I can put it that way, before the reshuffle. I was not present at any of their meetings but there were brief discussions about what might happen. The issue was, if there was a licence, who would issue it? We had to make a decision. Did Defra do it or did we ask Natural England because they do the licensing of wildlife issues? Now, this is a very sensitive issue, it is an emotional issue as well and there were arguments played both ways in the Department. David and Ben took the view there was no good reason why the licences should be issued by Defra when we have got a perfectly good non-departmental public body dealing with wildlife and, therefore, discussion was

had but they were not discussions in anything like detail because, first of all, no decision was taken in principle at all. We had not got the ISG report anyway. If a decision in principle is taken, and I say "if" a decision is taken in principle, by the Secretary of State on advice that we were going to do this, then we would open up discussions about the parameters of a licence with the licence giver.

Q603 Chairman: How can you take a decision in principle to do something without having decided how you are going to make the judgment on taking the decision in principle?

Lord Rooker: No, no, no.

Q604 Chairman: You have got to know how a policy works.

Lord Rooker: No, it is like a piece of string. Maybe a decision could be taken—

Q605 Chairman: A piece of string you can describe with some accuracy, I am not getting any accuracy at the moment about how these decisions are going to be made.

Lord Rooker: Yes, but you did not expect this to be simple, did you?

Q606 Chairman: Nothing in this field is simple. We have all been at it for many years.

Lord Rooker: That is right.

Chairman: You have been at it for at least a decade and so have we. I am not getting the degree of clarity and precision that I had hoped for this evening. I am not asking you for absolute numbers but I would like to know, you are sitting there and you have to make a decision in principle—

Q607 Mr Cox: How you are coming across, Lord Rooker, is that you do not have a clue. You do not have a clue what you are going to do.

Lord Rooker: The Department—

Q608 Mr Cox: You do not have a clue. You have said until we get a decision on what we want to do we cannot do X, Y and Z, well you are the ones making the decisions.

Lord Rooker: That is correct.

Q609 Mr Cox: Everyone is waiting for a policy.

Lord Rooker: That is correct.

Q610 Mr Cox: You are the one who is supposed to come up with a policy.

Lord Rooker: Yes.

Q611 Mr Cox: We have been waiting for it for years, and in fact it is two years since we were told it was going to happen.

Lord Rooker: That is probably why you could argue we have spent a billion quid to no good effect in the last decade in reality, because that is what it has cost us.

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Q612 Chairman: It may have done, but what we are trying to do this afternoon is tease out how you are going to deal with the body of evidence which is presently available. Some time in the middle of January, if you like, and we put our little two pennyworth in, you will have—you have them there—a pile of reports, you will have our modest contribution and you will have no doubt a load of other material. You will have to sit down and work out what you are going to do. In terms of making the decision, as you say, in principle, no secretary of state can make an in principle decision without it being well-formed. There have got to be some facts and information that stack up underneath it. If in terms of culling the Secretary of State is going to reach a view “yes” or “no”, which I presume he is going to, somebody is going to have to describe the parameters. One of the things we are just exploring is the effectiveness and the terms under which a culling process might or might not be granted. What are those terms?

Lord Rooker: Sorry, it is perfectly possible in this case to make a decision in principle to say we are not going to deal with the reservoir in the wildlife, irrespective of all the evidence, and to make that decision and then try and argue the case, if you are challenged in court, that you have acted quite reasonably because of the series of issues. You can make a decision in principle, in some ways that partly is the key decision, the policy will flow from that decision. Are we prepared to deal with the reservoir in wildlife or are we not? That is a fair question to ask people. I have not come here with an answer “yes” or “no” to that today because I have no authority to give you an answer “yes” or “no”.

Q613 Chairman: Give us a hint here. Let us assume that you went down the route you have just enunciated, you decided you were not going to deal directly with the wildlife reservoir. You said earlier that the taxpayer’s buck had stopped. If anything, we want it to be smaller, so when you make this decision or any other decision, are you going to publish, if you like, a menu of options about what you will use the remaining taxpayer’s money for in whichever direction you decide to go?

Lord Rooker: No, that is too simplistic a way of doing it in that respect. If that was the decision, you have immediately then got an over-arching policy. You can then say to industry it is the over-arching policy so we can put aside any aspirations people might have had of, say, dealing with the reservoir in wildlife. This is what we now are faced with. How do we deal with it? We still need to work in partnership on this, Defra cannot deal with this on its own.

Q614 Chairman: We know all that.

Lord Rooker: I am just telling you.

Q615 Chairman: What I am trying to get out of you is are people going to have some idea of the resource which Defra is going to be making available for whichever route you go down? Is there going to be a menu of options? For example, if you decided that you were going to deal with the wildlife reservoir,

and you said Defra are not paying for it, then there is only one body of people who are probably going to go out and deal with the wildlife reservoir but there are some consequences which come from that. The consequences are what are you then going to do about the cattle testing policy, the compensation policy as is at the moment, there may have to be changes in that, what is Defra’s input to further work if any on biosecurity, what is Defra’s commitment to the work that is going on with the VLA on vaccination, are people going to be shown what the consequences in financial terms are of the options that you decide?

Lord Rooker: Not before we start. You raise—

Q616 Chairman: When you come to a conclusion you are going to do this?

Lord Rooker: No, no, even the issue of vaccinations is not that clear-cut. Vaccination of cattle might look all right but it could be catastrophic for trade purposes, major, major problems. Obviously it is a lot easier to administer vaccine to cattle than it would be to wildlife. If we found a vaccine for the wildlife who would pay for it? Who would pay for it?

Q617 Chairman: That is exactly the point I am getting at.

Lord Rooker: That is the point I am making. That is why there is no clear-cut answer.

Q618 Chairman: This is why I come back to ask the question again. When you make your decision, and no doubt you may want to consult on certain aspects so you are going to have to have some hard information as a result of all this enquiring and knowledge which you have been accumulating, are we going to see some cast-iron costed options of what Defra is willing to pay for under whatever scenario you eventually decide?

Lord Rooker: I think you may see that anyway once we have made our decisions on the Comprehensive Spending Review for the following three years. I cannot go beyond that. As I speak at this time, no decisions have been made but the implications of what you have just asked me in your question will be apparent by the time we have made the decisions quite outwith bovine TB, as you understand, but because bovine TB is such a big part of animal health and animal disease it is implicit in that—

Q619 Chairman: Does that reflect the fact that you have already raided the Animal Health budget to keep the Rural Payments Agency going in the current financial year?

Lord Rooker: When did we do that?

Q620 Chairman: It is in the supplementary estimates.

Lord Rooker: When was that?

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Q621 Chairman: Which were published last week.
Lord Rooker: How much was that?

Q622 Chairman: I cannot tell you without looking at all the detailed figures but my understanding was that the Animal Health budget had been reduced and some of the money had gone in to fund the RPA.
Lord Rooker: The consequences of RPA, we have had this time and time again about the RPA have cost more than we intended but the fact is we have not had to go round raiding everybody else's budgets for it. Our cost and our cuts, if I can put it that way, or adjustments to the budget of various bits of our Department are completely— The RPA was about 10% of the total adjustments to the budget, the other 90% was because of other issues, nothing to do with the RPA. I would be very surprised if there is a Defra document, and I have not seen this by the way—

Q623 Chairman: If I am wrong, I apologise but I can re-read it.

Lord Rooker: No, I think the idea was we published a document saying “we have chopped the Animal Health because of the RPA”. You will be very pleased, by the way, although I do not want to divert you from what you are asking but as I sit here some farmers in England today have had money in their banks for their Single Farm Payment from a test run we did late last week.

Q624 Chairman: There we are. Some people are lucky. I want to move back to the main agenda. Mr Cox wishes to pursue this.

Lord Rooker: You raised the RPA, I did not.

Chairman: We will have you back on the RPA, do not worry. If you want to talk about that we will have you back to talk about it but Mr Cox wants to go back to bovine TB.

Q625 Mr Cox: That would be useful, I think. Lord Rooker, could I just understand, you mentioned earlier on in your presentation to us that there was a problem with section 10 of the Badger Protection Act which requires the consent to a licence of the licence authority not to be unreasonably withheld. I have got two questions really, the first part of which I will ask now. What has been the reason for the last ten years for withholding consent to a licence?

Lord Rooker: Because of the randomised badger culling trial.

Q626 Mr Cox: The justification for not issuing licences has been that there is a scientific inquiry going on.

Lord Rooker: We stated there was a moratorium on issuing licences whilst the trial was going on.

Q627 Mr Cox: Now that is over, as you rightly point out, and has been over essentially practically for some considerable time—

Lord Rooker: Yes.

Q628 Mr Cox: Because the actual trial stopped—
Lord Rooker: 18 months ago.

Q629 Mr Cox: —18 months or more ago now. You have a situation, as you rightly point out, do you not, where if you have applications on the table you do need to move fast because the justification that Defra would have put forward in law has disappeared.

Lord Rooker: That is correct.

Q630 Mr Cox: A court would be likely to say, “Well, unless you reach a judgment fairly soon, your withholding of the consent is likely to be unreasonable”.

Lord Rooker: That is absolutely correct. That is why a decision cannot really be delayed much longer from when you issue your considered report. I have no doubt that there will be some fast decision-making in Government, I do not mean overnight but the fact of the matter is the industry or those who want to apply, or who have licences in the queue, by the way, we are sitting on them as far as I am aware but they are ready to come in anyway, and we will be asked for it and the fact of the matter is it makes it quite clear in the legislation, which is very brief, a licence under this section shall not unreasonably be withheld or revoked.

Q631 Mr Cox: Yes.

Lord Rooker: We have had a good reason for that over the last ten years.

Q632 Mr Cox: You say so, I am not sure that is true.

Lord Rooker: Yes, but we have not been challenged.

Q633 Mr Cox: You have not been challenged, that is very true.

Lord Rooker: We have not been challenged and that is the test in a way.

Q634 Mr Cox: Yes.

Lord Rooker: The risk of challenge is very substantial, there is no question about that. Are we satisfied in having the situation where there is no clear-cut policy that we want a judge to decide? I am not sure if that is something I would be too happy about, I would rather we can get a policy that has got a consensus to it, parliamentary wise and industry wide, and preferably wildlife groups as well. That is much better than having a judge decide that you have unreasonably withheld the licence and therefore we have to issue one and we have got less control over it, I would imagine. That is the situation. Not many people raise this issue, it is almost unique, simply because the legislation there is for badgers but not other wildlife in that sense.

Q635 Mr Cox: What you could argue is that the state protects the badger by virtue of the legislation. It prevents a landowner, farmer, from managing the wildlife on his land and, as you will know, that is an integral part of any farming activity, to manage the wildlife responsibly on your land. It has interfered with his rights to manage his own land, to manage

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the property on his own land, the wildlife on his own land; it has interfered with his right to take reasonable precautions to prevent disease on his own land. It really is incumbent on the state to provide him with a solution and the solution the Badger Protection Act came up with was to enable the state to grant licences. This Government has prevented even that. We are now looking, ten years having gone by, at landowners having been prevented from carrying out perfectly reasonable actions on their own land where we really do need a decision or a justification at least for not allowing them to get on with it.

Lord Rooker: That is absolutely correct, it is the timing of it. As I said, this legislation came in originally in 1973 and 1991, the 1992 Act is a consolidation in a way, but it came in to protect the badger, and rightly so, from badger baiting and all the other horrible acts that were taking place. It was nothing to do with TB, TB had not been discovered in badgers. The issue of being able to issue a licence, and the legislation, when it is drafted these days you get about a volume of 50 pages rather than a dozen, makes it quite clear for the purpose of preventing the spread of disease you can issue a licence. It is not specific what the disease is, and I discussed this with officials last week. I have to say, and I will be quite frank with you because this is not an issue you should deal with, my challenge to your Committee was if you came down hard and fast against any dealing with the wildlife reservoir you would ask yourself what is the purpose of that piece of legislation, when would you ever use it? The answer came back to me, quick as a flash, rabies. In other words, therefore, it is a long-stop so the disease is not qualified—

Q636 Mr Cox: It does not say “rabies” it says “disease”.

Lord Rooker: It says “disease”, that is why I am being open and candid with you.

Q637 Mr Cox: It was open-ended precisely because wildlife could be a vector in the spread of all kinds of diseases.

Lord Rooker: The Act of Parliament there has not been operated, as I have said, during this trial, because—

Q638 Mr Cox: And many would say possibly unlawfully but the situation now—

Lord Rooker: It has not been challenged.

Q639 Mr Cox: I accept that. That may be the timidity of those who are anxious not to undertake against the state a very expensive legal action. The reality is now there is no justification, you have accepted that, and the Act of Parliament presumes the granting of licence.

Lord Rooker: It does, yes.

Q640 Mr Drew: Whatever policy you come up with, Jeff, there is going to be opposition. You already quoted it.

Lord Rooker: Yes, sure, I realise that.

Q641 Mr Drew: Possibly vaccinating cattle could lead to the loss of TB free status so the NFU are highly likely to object to that. If you go for a culling policy there will be a large number of organisations, we know historically and that has been restated in the evidence to us, which will oppose it who are large landowners and that therefore leads to huge management issues in terms of what you would want to happen out in the countryside.

Lord Rooker: Sure.

Q642 Mr Drew: In a sense what I am concerned about now is if it seems we are unclear exactly what the Government wants to do, given that it is waiting for our report, it is waiting for various other reports, how do you manage that opposition?

Lord Rooker: Building a consensus on this is not easy. I have tried always not to use inflammatory language, and I am seeking not to do that today, I am trying to tell it as it is. We deal with other areas of wildlife, whether it is the ruddy duck, the deer, the grey squirrel, almost satisfactorily by and large. There can be a consensus and I would want to build as much consensus on this because number one, and this was what was set out originally for the ISG, Jack Cunningham and I made it absolutely clear and Elliot as well at the time, there was only a small team at MAFF, under no circumstances would the government countenance a policy to eradicate badgers, and that remains the position. There is a hardly a badger alive today that was alive ten years ago, do not forget, 300,000 or 400,000 population, average lifespan four years, 50,000 killed by motorists allegedly. Some of them live a lot longer than that but the motorist does more killing than any of the farmers. The fact of the matter is you have to build a consensus. There are people who will not go for a consensus, do not agree with eating meat, do not agree with animal trade, therefore you have got to see where you are coming from. We have got an important economic issue that has to be dealt with, it is a countryside issue, it is a jobs issue, it is disease control in a disease that is zoonotic, it is a notifiable disease. It is an offence not to report it. There is enough going here, I would have thought, to hope to build a consensus as long as there is clarity at the top, and there is not, I freely admit that. There is not that clarity at the top because of the difficulty of setting up Krebs, Zuckerman, the lot. You can look at the history of this. We have reached the point now where the buck has stopped, we cannot have another two years, say, of doing a pilot or a trial, we have gone past that stage because, literally, someone will operate the Act and in mentioning the Act, as I have done today, I am not inviting anyone to do that. The fact is it does not figure in the discussion. The vets do not figure in the discussion and yet they are the ones out there telling me that 70% of the cattle TB in the West Country is directly responsible from the wildlife.

Q643 Mr Cox: That is on the forms that the Animal Health Agency had to fill out. If you look at the forms that they fill out it will say “attributable to . . .”

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Lord Rooker: And leaving aside the costs which I have elaborated on at some length, which is an issue, lots of things were not tested in the ISG. The frequency of culling was not tested for example, that was not an issue, they did not set out to do that. There is a lot of do not knows. I have often quoted paragraph 10.49, it is all the do not knows we do not know. That does not mean to say we cannot go forward and try and build a consensus to deal with this issue but that will not happen unless some principal decisions are made.

Q644 Chairman: Can I just explore with you this consensus building operation. Is that going to be a part of the process before you come to a conclusion? For example, will industry, those who favour badgers, all the other people who have their two pennyworth to put into this, are they going to be brought in for a discussion before you reach a conclusion?

Lord Rooker: Yes. I can say yes to that positively because Hilary has not met most of them and he intends to do so before he reaches a final decision.

Mr Drew: He is going to be very busy.

Q645 Chairman: Is there going to be a more formalised part because you have a parallel agenda, you are going to be talking about cost-sharing and one of the arguments which the Secretary of State made clear was that the reward for putting some money in the pot was a seat at the table where decisions about the handling of animal diseases will be made. Will the decision on cost-sharing be made first so that those who are sharing the cost can take their seat in order to make decisions about the handling of this particular animal disease?

Lord Rooker: I think the answer to that is no because the timing is wrong. The fact of the matter is we have to make a decision on bovine TB. It has to be done pretty imminently, early in the New Year. I was using the ministerial early in the New Year—

Q646 Mr Cox: Any time up to the autumn!

Lord Rooker:—the way you understand it. The cost and responsibility sharing agenda for a paper we publish hopefully before Parliament goes to recess, a 16 week consultation, say a period of chats in the Department with others, then a policy later, that is a long way off and with the negotiations and discussions starting in Brussels—

Q647 Chairman: It is a bit odd this.

Lord Rooker: Yes, it is, is it not.

Q648 Chairman: At the beginning this was the biggest single animal disease cost-wise, particularly for Defra.

Lord Rooker: Yes.

Q649 Chairman: The decisions which are going to be made on it are not going to be ones built by a consensus of the people who may be in the cost-sharing group later on but who are very much involved in the disease as of now. You are going to

make your mind up for the people who will then take a place at the table. They are going to feel a bit left out, are they not?

Lord Rooker: Put it this way, it is going to be difficult to discuss cost and responsibility sharing in the absence of an in principle decision on this. That was made abundantly clear to me when I went to Cardiff, it was made clear by the way in England. I do not want anyone to think the NFU and the rest of them have not put their case, they have. It is almost axiomatic that people say, and they have said it to me, we are not even in the business of cost and responsibility sharing unless you make a decision about a policy on bovine TB. For example, some would say, to cull or not to cull, obviously from the farmers' point of view, the majority, not all of them, would want the ability to be able to cull before they start to discuss this. That is why it is going to be difficult, I freely admit that. The fact is the bovine TB policy and decision is almost in parallel with the cost and responsibility sharing discussions that we are having.

Q650 Mr Cox: Can I raise one other issue and that is the question of the compensation, Lord Rooker. I think you have covered it in the sense that you said the status quo is not an option. At the moment the compensation is producing real injustice at the upper end of the market for high genetic value animals. I have an example in my own constituency currently which I have written to Hilary Benn about.

Lord Rooker: I have the letter here.

Q651 Mr Cox: You have got the letter. £20,000 that animal, probably one of the best breeding stock in the country, and he is going to get £1,400.

Lord Rooker: Sure.

Mr Cox: All he wants in that case is a retest. I am not going to raise the individual case with you now but that is an example of the kind of deep injustice that is being done at that end of the scale, I am not saying in the standard and ordinary situation with high genetic value animals. I had another case recently, 89 gone down on the gamma interferon test at one go, Tony Yewdall, who is well known I think to the Ministry, suddenly the gamma interferon test produces 89 when the skin test produced only one. Firstly, you are right, gamma interferon is bound to produce a hell of a lot more for culling but, secondly, there has to be an examination at the same time when you are looking at cost-sharing, when you are looking at putting culling as an instrument of policy at this end of the compensation spectrum.

Q652 Chairman: We want to hear this answer.

Lord Rooker: I know you do.

Mr Cox: I was told by officials a year or so ago—

Q653 Chairman: Hang on, let the Minister answer because we are hanging on your every word.

Lord Rooker: I know you are, that is why I am being very careful about what I say.

Q654 Chairman: Right. Do you want to phone a friend!

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Lord Rooker: No. The status quo is not an option and that is what I am sticking to.

Q655 Mr Cox: A year and a half ago officials told me, sitting in Ben Bradshaw's office—

Lord Rooker: Am I safe to say the status quo is not an option? I am, am I not?

Chairman: Asking a member of the audience, that is one life gone!

Q656 Mr Cox: The pendulum had swung too far against the farmer in that situation, that is right, is it not? Your own officials said that. Ben Bradshaw's did to me in a formal meeting.

Lord Rooker: I cannot comment on that, that is hearsay.

Mr Drew: Can I try another angle of attack!

Mr Cox: Exploration!

Chairman: Probe. We do not attack a minister, we probe him.

Q657 Mr Drew: It is interesting what Lord Rooker has to say. Let us say that you make the decision in the New Year for a particular policy option and by the nature of this disease it does not solve the disease problem because if it was all that easy not only the Irish would have felt more satisfied with where they got to but New Zealand, which is another country which faces the ravages of bovine TB. These policies have always been interim because I have always believed, unless I have got this wrong, that eventually we would move to some form of vaccination. Now you have somewhat dampened my enthusiasm for the animal reservoir vaccine approach if you say, "Who is going to pay for that?" I cannot really see anyone paying for it, apart from the state, but that may save the state an enormous amount of money if you could prove that you could dampen down the disease. How can we feel that what is decided early in the New Year is the right policy if there are possibly alternatives which could arise in the due course of time? Is that something you will look at the options of or could you say, "Vaccination, nice idea but we are not prepared to wait ten years" or even, as we have learned, until 2010 where the inhaled vaccine will be available for badgers?

Lord Rooker: First of all, whatever is decided it is a bit like the pre-movement testing as a policy, the question is what has the effect been in disease terms? It takes a while, the incubation period and everything else. You are not going to get an instant answer and, by the way, on the cattle vaccination it would be quite illegal at the moment to do it. Even if there was a vaccine, we would have to go to Europe and get the law changed. This is not a straight forward issue, leaving aside the economics of the vaccination and not losing the TB free status—GB does not have OTF status and the vaccine hiding TB in the cattle over trade issues, the fact is we would have to go to Brussels to get permission, to get a law changed. It is something only time will tell.

Q658 Chairman: Why are you funding research into it then if you think there are all these problems about using it?

Lord Rooker: I am being realistic with you. That is not a reason not to do the research and not have a vaccine.

Q659 Chairman: I thought you were trying to save money.

Lord Rooker: We have been under pressure for years. One of the recommendations of the Krebs report was that we went in to look for a vaccine. We had always been told it had been looked at before, we were always told ten years away, as you have heard yourself, slightly less than that now. We have always been told that. It was classed as a Holy Grail, get a vaccine for the cattle or the badger but delivery is difficult for the badger one. That does not alter the fact, it is a bit like if we went for vaccination, as we did not have to for foot and mouth, but we were ready to, that in itself has implications. In this case, getting the vaccine gives you the option, we have not got the option at the moment because we have not got a vaccine. If we had got a vaccine and got an option that was worthwhile economically, a case could be made probably to Brussels because we are the odd one out in Europe along with the Irish in terms of this disease and, therefore, I am not saying it would be impossible. What I am saying is if there was a vaccine there tomorrow we could not use it legally, we would have to go to Brussels to get approval for it, that is all I am saying. That is not a reason for stopping the research.

Q660 Paddy Tipping: Let me ask you specifically about that because vaccine is an option which might well build up a consensus and you have invested in it heavily. You made a point a little while ago about the CSR and decisions, could they be made, and if we look closely at the CSR we would see some indications of policy. Put bluntly, are you going to continue to invest in vaccine development?

Lord Rooker: There is no plan to stop that. That programme is underway. We have been encouraged to do more. I do not think there is much of a chance of stepping it up, bringing forward the dates which are already planned but the funding that is in place at the present time for both the cattle vaccine and the badger vaccine, to the best of my knowledge, is not being interfered with and we will proceed. The timescales are far less than they used to be and, as far as I am aware, I am not aware they are on the agenda. There is an agenda obviously, there is a set of options but we have not made any decisions yet.

Q661 Chairman: I want to move to one area we have not touched on in our discussions so far by way of conclusion and that is on-farm bio-security. There seems to be a lot of talk about it but there does not seem to be much by way of effectiveness. What is Defra doing to try and devise truly effective on-farm bio-security strategies and advice and, secondly, what is Defra doing to ensure that message gets through and is acted upon by farmers?

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Lord Rooker: I cannot give the figures off the top of my head but we have spent a fair bit. On-farm bio-security covers two areas in a way. The buildings are easy. I have been on farms where I have been in the farmyard, I have looked at the sheds, huts and the hole called a doorway and I have looked at the door and thought, “Bit of a gap when that door closes, top and bottom”, and I have seen this in the recent past and think, “Haven’t they learnt the lessons?” The buildings are the easy bit—we have given advice, leaflets, it is on the website, we have had workshops. If you then come to on-farm bio-security, essentially what you are talking about, because of the implication, is separating the badgers from the cattle because it is accepted there is a link. If you do not accept there is a link, you have not got a problem, have you? It is accepted there is a link, what we do not know is what the transmission route is. Electrified fences, I do not think, are a runner—

Q662 Chairman: Sorry, you said you do not know what the transmission route is?

Lord Rooker: We do not.

Q663 Chairman: It is a bit central to a strategy to deal with the disease, is it not?

Lord Rooker: That is the whole point I am making. You can keep the badgers out of buildings because you can lock them up—

Q664 Chairman: If it is that easy, why is it not being done more?

Lord Rooker: It is amazing, is it not?

Q665 Chairman: What do you think the reason is?

Lord Rooker: I do not know. Maybe farmers think, “If I do get TB, it is bad but I’ve had it before and the Government paid compensation, and I do a lot of testing”, maybe, I do not know.

Q666 Mr Cox: Or they may just be thinking, “We have to put our animals out on the fields, they will catch it there if they do not catch it in the sheds.”

Lord Rooker: Yes, and of course if the cattle winter inside the buildings anyway where they are herded together in greater numbers, that is a recipe for getting TB anyway, like the badgers do in the over-badgered setts. Because you said on-farm bio-security, I am dealing with it as the buildings and the land, the grazing, the interaction with wildlife, and people have come up with all sorts of issues—badgers can jump and dig, electrified fences I just do not think are a runner—but when you do not know what the transmission route is, it is very difficult. I go back to my paragraph 10.49 which is quite clear, Professor Krebs said in 1998, “Do this and we will know in five years’ time what the transmission route is, what the effect of it all is”, and I am not complaining to you about John Krebs’s view but he said, “This was the purpose”, and at the end of all this we still do not know what the transmission route is between badger and cattle. If that is the case, how can I say to a farmer, “Under the cross-compliance rules and all the other rules, you have to do this”, or “Natural England, the RPA, say these are the rules

you have to follow for keeping badgers away from cattle”, and he will say, “Why should I spend all this money when I do not know if what I am going to do is going to work? There is no cause and effect here.” So it is almost impossible. You can do the farm buildings, it is true. I was on a farm a few months ago and the guy said to me, “I could live with ten setts on the farm, I’ve got 16”, what am I supposed to tell him in terms of bio-security? You tell me. There is not an answer. He would laugh at me if I gave him advice, to be honest, on that scale. That is why it is so complicated and serious, there is no easy answer. I have been on farms where they have closed herds for 30 years, bought nothing in, and they have still got TB.

Q667 Mr Cox: So have I. Exactly. We know the badger is a factor, particularly in the West Country but the question comes back really, does it not, Lord Rooker, to when are you going to do something about it?

Lord Rooker: You asked me that an hour ago.

Q668 Mr Cox: With respect, I have listened to ministers and they told me in 2005 and 2006 that a decision was nigh. We were told by the Minister of State, the Secretary of State, in March 2006 that there would be a three month consultation and then we were going to have a decision. That was over a year ago, 18 months ago, and no decision. So we have heard ministers talk a good game before, and you are talking a great game, but it has to be followed by action this time, Lord Rooker, otherwise the consequences are going to be devastating.

Lord Rooker: It is not for me to do your job for you but I have brought with me my own words from 1998, so it goes back a lot longer than that, as far as I am concerned.

Q669 Chairman: What did you say in 1998? Do tell me!

Lord Rooker: I thought you had done your homework! A previous Agriculture Committee, Bovine TB Reports. I have been here before! Other ministers have come after me but I had responsibilities at the beginning. I have read my own evidence and I am gratified that I agree with it all today as well, so that is quite helpful, having been away from it.

Q670 Mr Cox: Are you confident you can get a decision?

Lord Rooker: That is what I am coming to. Given the procrastination of this over the years—I can defend the procrastination for the science and the research and the reports—

Mr Cox: The last one was because of the statistics—

Q671 Chairman: This is the build-up, let him finish. This is the peroration part of the evidence, I have been looking forward to this.

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Lord Rooker: I will not be able to defend a non-decision for too long after you report, because what else do we need to know, what else do we need to do? 2008—I did say early—is a year when a decision about our policy has to be made so we can take it forward.

Q672 Chairman: We have gone from “early” to a year, so there has been a bit of slippage already in this.

Lord Rooker: No, I mean early.

Q673 Chairman: Early in the year, to be precise?

Lord Rooker: My view is, you, your Committee, have to insist. You have heard this, as you have said in the short time you have been in the House, and I can quote you chapter and verse about this from ten years ago and there will be other ministers, former ministers, Douglas and the others, who appointed Krebs in the first place back in 1996, who would have said the same thing, “We have another inquiry, let’s wait for it”. My view is, do not fall for another inquiry if one comes. There is no indication there is going to be one, we do not want—

Q674 Chairman: You have said you are not affording anything, so another inquiry I think we would—

Lord Rooker: The fact is, we have to be practical and see if we can deal with the disease and stop it spreading, see if we can reduce it in the hot-spots in a way which is commensurate with good husbandry, respect for wildlife, respect also for the fact we have a large industry of food animals there with a huge trade potential once we get trading live animals again, or animals on the hoof as it were, if we can, and we have to do that in the round.

Chairman: Minister, upon that happy note, which possibly might be the only point of consensus we have reached all afternoon, I am going to bring this to a conclusion. Whilst I think it is clear you have described the problem and the elements which might ultimately make up the solution, the Committee will want to study very carefully the words you said about the way in which this decision is going to be made. I think there would be, however, unanimity of agreement that as early as possible in 2008 a real world, practical decision and a plan encompassing all the elements you described has once and for all got to be made. Thank you very much for coming to give evidence.

Memorandum submitted by The National Farmers’ Union

A PARTNERSHIP APPROACH TO TB DISEASE CONTROL

1. The NFU is grateful to the committee for giving us the opportunity to comment on Lord Rooker’s oral evidence session which took place on 10 December, in particular the issue of government/industry partnership and controlling the disease in the wildlife reservoir.

2. We were dismayed to hear the Minister apparently declaring that there would be no financial resource or government involvement in badger culling. As Lord Rooker says himself in his Foreword to Defra’s consultation on Responsibility and Cost Sharing (published 11 December) “animal health delivers wider economic benefits. Public health and other public goals. Therefore, it is right that the public, as taxpayers, should also pay a proportion of the cost”.

3. The ISG concluded that a badger cull would be prevented from working due to a lack of farmer co-operation and commented that farmers must take responsibility for bTB. The VLA 9 project,¹ with over 1,200 completed and signed licence application forms—representing 70% of the farmers in the VLA9 area—should reassure the Government that the industry is willing to work in partnership to control and eradicate bTB from the hot spot areas.

4. The Committee’s Chairman and some of the Committee members received a presentation on this project and a copy of the Seven Point Plan (the industry’s agreed statement, made after stakeholder discussions over a year ago) when they visited Devon in October.

5. So what do we mean by working in partnership? We would refer the Committee to points 2–4 of the Seven Point Plan:

2. Industry participation in a badger culling programme can only be in the context of a genuine partnership with Government, involving their providing overt facilitation, mapping, monitoring, carcase disposal and other support.
3. TB Control Strategy Groups should be set up, aligned with DVM areas, involving farmers, vets, the SVS and other stakeholders to determine overall strategy for their area, to advise on the delineation of control areas and facilitate the creation of local TB management groups.
4. Culling to be carried out by trained contractors engaged by TB management groups using cage traps and shooting in the short-term, and CO (carbon monoxide) gassing and, possibly, stop snaring, when these methods are approved.

¹ The VLA 9 project is a badger control template which is supported by farmers in a specific area of the south-west affected by the VLA 9 spoligotype of TB.

6. The VLA 9 project template has been designed to reflect the industry agreed 7 Point Plan. The project's responsibilities could be shared between farmers, by providing the labour and machinery, working closely with their local vets and in conjunction with Animal Health, with the national support and partnership of Defra to ensure the continual and detailed mapping, monitoring and evaluation of the project over the course of its term. Management teams would be set up within the VLA 9 and other similar projects across the country. Representatives from these management teams would meet regularly to ensure effective management, communication, reporting and monitoring was shared amongst stakeholders.

7. The NFU feel that it is vital that Defra, using Animal Health expertise, take a full part in the mapping, monitoring and carcase disposal of any badger cull. Animal Health vets would have an in-depth understanding of local TB problems and would be the one organisation who would be consistently visiting all cattle herds in a project area. They would have immediate access to disease recording data, herd health status and management regimes. They already advise many farmers on badger/cattle biosecurity and this must continue in any culling project to reduce the risk of perturbation of disturbed badgers.

8. In his advice to ministers made in July (and published on October 22) the Chief Scientific Adviser, Sir David King, in recommending that a badger cull should be implemented, was very clear that it should be monitored and controlled. He stated "The incidence of TB in cattle in the removal areas should be monitored on an annual basis. After four years, the badger removal programme should be reviewed. This may entail some assessment of the prevalence of TB in badgers. The badger population should be monitored".

9. We fully support these recommendations but are firm in our view that this is a programme that the industry could not achieve without the full co-operation of and support of government. The limits of the capacity of the industry to act on its own is reflected in the current Defra consultation paper on responsibility and cost sharing in paragraph 3.3: "In certain situations, such as when the industry does not have the capacity and or the capability to deliver an activity, there remains a need for Government to intervene".

10. This need for Government involvement is not merely an NFU requirement. In December 2006, NFU commissioned a report on the public perceptions on farming, badgers and TB (The report was included in the Defra Committee's pack during the Devon trip). The conclusions of the report were found during focus group discussions facilitated by external and independent facilitators. One of the main conclusions of this report was that the majority of respondents would be in support of legal culling of badgers but they do not feel that farmers should take the lead on it. They would want strict guidelines in place and suggest that the lead would most likely come from Government or vets.

11. To summarise, NFU are confident that the cattle industry is willing to play its part in any wildlife control strategy which has the objective of reducing the incidence of bTB nationally, but we are certain that this could not be successfully achieved without the partnership and intervention of government and its agencies.

Written evidence

1. Letter to Mr Roger Williams MP from Rodger Garratt

Thank you for sending me a copy of the ISG's report on their investigation into the epidemiology and control of TB in cattle. It is a comprehensive document and has taken some time to read and digest. As a result my response has taken some time to assemble.

You said that you would be grateful for any input I could offer. Accordingly I would like to offer you my comments under four separate headings:

- General remarks
- Specific remarks
- Anecdotal observations
- Conclusions

GENERAL REMARKS

1. *Independent research or not?*

The findings of this piece of Government initiated research by an "Independent Scientific Group" must immediately be brought into question by a statement apparently innocuously hidden in this vast document.

How can one seriously trust the independence of this body when they openly state on page 39 in paragraph 2.27 that "Added to this, the ISG had been given a very explicit declaration by Ministers that elimination of badgers over large tracts of the countryside was not acceptable as a future policy."?

With such constraints at the outset, it is unthinkable that any trial design would be robust or extensive enough to test the efficacy of culling badgers on anything other than a relatively restrictive scale.

The only question that this piece of research has answered, is that if the culling is restricted to such limited areas (100km²) the benefit is equivocal, although it would appear that the ISG did admit that persistence in proactive culling began to show benefits. So, how much better would it have been on a wider scale?

2. *Scientific conclusions, or not?*

Looking dispassionately at the report, the overwhelming impression is that this whole piece of research has been contrived by statisticians and the subsequent presentation of the results dictated by statisticians. This may give it the veneer of being a piece of scientific veterinary research, but we all know how malleable the interpretation of statistics are to bias and subjectivity. Reading through the analysis of all these figures it soon becomes clear how much this may indeed be the case. For a document purporting to be scientific, it is worrying to notice how frequently phrases such as "unlikely to", "likely to", "could", "suggest that", "appear to", "may be", and "expected to" are used, to name but a few. I find this alarming and disquieting in trying to assess the true objectivity and consequential validity of the conclusions that are eventually drawn.

Adding to this the doubt about the genuine independence of this research I find it very difficult to be comfortable with its conclusions.

SPECIFIC REMARKS

1. *Historical evidence*

I feel that the significance of what happened back in the seventies has been largely dismissed by the ISG in terms of its relevance to the present situation. I strongly disagree with such a view. From 1968 and through the seventies and eighties I was in practice in one of those problem areas described on page 28 (paragraphs 1.5 and 1.6), namely Wiltshire. We had a number of problem herds in the early seventies. Following the elimination of all the setts in the area by repeated gassing, these herds had no more TB breakdowns up to the time when I left the Practice in 1990. This was fact as I observed it.

One has only to look at figure 3.1 on page 59 to appreciate that the lowest level of TB disclosure occurred between 1977 and 1988 after which it began to rise and has done ever since. The end of the seventies was when gassing became an unacceptable method of culling as the huge rise in public opinion following The Badgers Act of 1973 began to influence political opinion. This was fact.

In the late sixties when TB appeared to be approaching the point of eradication the only real problem areas were where there was also the highest densities of Badger populations. This was also fact and too significant to be dismissed as coincidence. I also know as a fact that even before and also during the gassing of the seventies, farmers were carrying out their own assaults on setts and so by the time the moratorium was called in the early eighties, the combination of official and unofficial sett destruction had reduced the badger population, certainly in Wiltshire, to the lowest level for some time.

From that point forward, the badger population, totally unchecked, began to recover at a rapid rate. Family groups grew too large and began to break up, with expelled badgers meeting other expelled individuals and creating new setts of their own. Almost certainly, infected badgers with a level of resistance to the disease established in their own groups, met and infected badgers with no resistance from other, clean groups. This was undoubtedly natural perturbation and in my view contributed significantly to the sudden dramatic rise in TB breakdowns in the early nineties and has been doing so ever since.

Again it is no coincidence that these dramatic rises have been seen in exactly the same areas that gave the problems in the sixties. What is different is that these areas have grown more extensive as the unchecked rise in badger population has created natural perturbation into widening contiguous areas. One of the most indicative signs of this increasing population is the dramatic rise in the number of dead badgers seen on the roadside. One rarely saw a dead badger in Wiltshire in the sixties and seventies.

I know that this section is reiterating known facts, but I have included it to emphasise that I believe that the culling of badgers would significantly contribute to the reduction of TB in cattle, but only if carried out on a large and efficient enough level. It did in the past and would do so again. The level, efficacy and persistence of culling carried out in the ten proactive and ten reactive trial areas were on an inadequate scale to show this to be so.

What makes it even more difficult is that we have a far higher badger population to deal with than was the case forty years ago, because with no official or unofficial control, badger numbers have risen exponentially.

2. *Proactive culling in the trial areas*

The ISG conclusions dismissed this option as being ineffective in reducing cattle TB in these areas.

However I would question how thorough the culling really was in these areas. Access was only allowed on to 70% of these areas. (Page 169 paragraph 10.35ii) That's only just in excess of two thirds. Traps were placed along the edges of the prohibited areas, but compared to traps placed close to setts and pre-baited before being set, not very satisfactory. It was admitted that there had been reduction in the trapping numbers due to sabotage.

Nowhere in the tables or text could I find a clear indication of the estimated badger removal by proactive culling as a percentage of the original population.

Unless one can quantify the efficacy of removal how can the failure of cattle TB reduction be blamed simply on perturbation? I would suggest that is a biased conclusion.

3. *Perturbation*

The ISG report cites perturbation as a counterproductive effect of culling within a trial area (cf paragraph 2). However there is absolutely no recognition of the fact that natural perturbation due to the unchecked growth in badger population may be a factor in the contiguous spread of cattle TB radially from the traditionally troublesome areas (cf paragraph 1).

I find this a very unbalanced view.

4. *Epidemiology—Cattle to Cattle transmission*

The evidence of respiratory transmission between cattle is based on the intranasal inoculation of the donor animals with M bovis. Such experiments have then shown that these artificially infected cattle can transmit disease to clean in-contact cattle. This is making an initial assumption that this is how infection occurs in the field; but does it?

What if, because of the idiosyncratic grooming habit of cattle, infection is transferred from the mouth to the nose by the tongue? Cattle are the only domestic species to push their tongues into their nostrils as part of their normal grooming process and they do this on a very regular basis.

If cattle do transfer infection from their alimentary tract to their respiratory tract in this manner would they necessarily be equally likely to transmit infection to the respiratory tract of other cattle as they are shown to do when artificially infected? Although this would account for the transfer of infection to their own respiratory tract would it necessarily result in equal risk to other cattle. I am not at all convinced.

I believe that this doubt needs to be investigated, because it could alter the long-standing and I suspect somewhat spurious assumption that the transmission of M bovis closely models that of M tuberculosis in humans.

The ISG report mentions that increased movement of cattle within high-risk areas and from high-risk to low-risk areas is undoubtedly a significant source of increased herd breakdowns. What I looked for, but couldn't find was whether there were any tables identifying further spread within the herds that had broken down as the result of importing an infected animal.

I must deduce from my failure to find such evidence that any consequential spread within these herds was not observed. The text from page 175–178 (paragraphs 10.64–10.75) seems to confirm this. If cattle to cattle transmission really is a significant cause of the escalation of the disease generally then surely the failure to find significant evidence to this effect is most surprising?

5. *Epidemiology—Cattle to Badger transmission*

Until the 1930s the main site of cattle TB was the mammary gland and in humans the site of *M bovis* infection were the lymph glands of the throat, a condition known as scrofula. The introduction of milk pasteurisation eliminated this human condition, but it wasn't until the eradication of cattle TB gathered momentum together with a greater understanding of milking hygiene that TB mastitis was eliminated.

It is my view that until this point the only plausible source of TB infection in badgers was via the licking up of TB infected milk that had leaked out from cows lying at pasture. In those days most grass was permanent pasture. Permanent pasture is a rich source of earthworms and earthworms are a favourite food of badgers. Added to this, I know for an observed clinical fact that milk leaks out from the swollen quarters of recumbent cows affected with mastitis.

It is also my view that since the eradication of TB mastitis in cattle there has been very little transfer of disease from cattle to badger.

There has been no research to investigate possible cattle to badger transmission whatsoever. Any prolonged close contact between badgers and cattle either at pasture or in buildings has not even been investigated let alone assessed under experimental conditions.

I therefore believe that to glibly make the assertion on page 173 (paragraph 10.49) that the most likely cause of reciprocal transmission between the two species is via the respiratory tract is a very unscientific assumption. Not only that, but it also demonstrates a serious ignorance of significant clinical knowledge that might serve to widen the perception to alternative hypotheses.

6. *Epidemiology—Badger to Cattle transmission*

What we do know is that the worst areas of cattle TB are associated with the highest density of badger population. We also know that the most common point of contact between cattle and badgers is grassland, particularly permanent pasture.

Whilst admitting that there is much scope for further research into the transmission of infection from badgers to cattle the overwhelming circumstantial evidence suggests that pasture is the most significant place of transmission and that, if there were no badgers on the pasture TB in cattle would not be a problem, as indeed it isn't where badgers are uncommon.

ANECDOTAL OBSERVATIONS

These case studies are taken from a paper I gave to Powys LVIs in the autumn of 1995 at the request of the then DVO. I include them to support my concern regarding the assumptions about *M bovis* transmission that have been made since the very inception of Inset 23 and that have been perpetuated ever since, up to and including the conclusions drawn by the ISG.

Case History 1

A farmer in Hay on Wye raised beef cattle for show. In order to augment each calf's milk consumption he would move the calf from the dam to suckle a "spent" milking cow purchased at market.

In this particular instance the cow had been purchased some four months (from October to January) when a routine test of the cow's herd of origin disclosed TB. I was asked to test this cow as a tracing. She was a reactor and I carried out the PM at slaughter. She had open TB (visible lesions in the lung tissue), which were culture positive. These lesions were severe, being of considerable size and number and could reasonably be assumed to be resulting in the exhalation of considerable amounts of *M bovis* infected material.

The herd was then tested. There were no reactors or indeed inconclusive reactors, not even the calf she had been suckling. A similar result pertained at the ensuing short interval tests and the herd was duly released from restrictions. Subsequent six month and annual tests also proved to be negative.

The infected cow had been indoors, in a building, sharing air space with several other cattle and in extremely close contact twice a day with the suckling calf, but there was no transmission of infection.

Case History 2

A farmer moved from Hereford to Powys in September with the intention of building up a 100 cow suckler herd. He purchased the same month 24 Hereford x heifer calves to bucket rear. The following May he sent these calves plus two home-bred calves to rented grassland in Herefordshire close to the farm he had left.

In October these 26 heifers returned to Powys and were housed together with five other purchased heifers, one homebred heifer and one homebred steer all summered at his farm in Powys. These 33 cattle were all housed in the same pen and in the same building as older homebred store cattle.

Four months later, in January, I carried out a routine herd test. From this group of 33 only the 29 purchased heifers had to be tested.

Of the 29 there were 17 reactors and one inconclusive reactor. All 18 came from the group of 24 that had summered in Herefordshire and of the 17 reactors five of them were open cases and culture positive. The subsequent whole herd test revealed no further reactors or inconclusive reactors at all. Nor were there any at the short interval or subsequent tests.

These five “open case” reactors had been in the same air space as more than 30 “clean” other cattle for more than four months, but despite the amount of infective material they would have been assumed to have been disseminating there was no transmission of infection. I must also add that this particular building was very poorly ventilated.

Case History 3

This farmer had his home farm in Powys comprising 50 suckler cows plus followers.

He takes summer keep each year from May to October on the same land in Herefordshire for around 60 strong stores, roughly half heifers and half steers. These cattle were then finished over the next nine months at the home farm and sold fat when ready.

The following history is very revealing:

May '92	TT		TB was detected in a fat animal at slaughter.	
Jun '92	TT	Powys	4 Reactors (summered at Hereford previous year)	
		Hereford	Clear test	
Aug '92	TT	Powys	2 Reactors (summered at Hereford previous year)	
		Hereford	Clear test	
Oct '92	TT	Powys	1 Reactor (summered at Hereford previous year)	
		Hereford	3 Reactors	
			Summered cattle moved back to Powys	
Dec '92	TT	Powys	1 Reactor (NVL culture -ve)	
Feb '93	TT	Powys	Clear test	TB10 served
May '93			c. 60 store cattle moved to Hereford	
Oct '93			c. 60 store cattle moved back to Powys	
Oct '93	TT	Powys	1 Inconclusive reactor	
Dec '93	TT	Powys	IR clear	TB10 served
May '94			c. 60 store cattle moved to Hereford	
Oct '94			c. 60 store cattle moved back to Powys	
Oct '94	TT	Powys	5 Reactors (all summered at Hereford)	
			3 Inconclusive reactors	
Dec '94	TT	Powys	Clear test	
Mar '95	TT	Powys	Clear test	TB10 served
May '95			c. 50 store cattle moved to Hereford	
			(all to be sold fat from keep)	
Oct '95	TT	Powys	Clear test	

There are two very interesting facts that are demonstrated by this breakdown.

- i) All the animals that were reactors over the 3½ years of this breakdown had been to Herefordshire for summer grazing and despite coming back at the start of each winter and being housed in the same air space with other cattle there was absolutely no transmission of infection to any other cattle.
- ii) The 60 or so cattle that went to Herefordshire each summer were roughly half heifers and half steers. These two groups were separated and grazed on different ground for the whole of the summer period, but within a few hundred yards of each other and there was a large badger sett close to both groups. In the case of the '94 outbreak all five Reactors and three Inconclusive

reactors came from the heifer group. What was so interesting was that the heifers were grazing old orchard, ie earthworm rich permanent pasture, whilst the steers on the other hand were grazing short term leys that alternated with corn crops and would have had very few earthworms.

I feel that this case history makes these two points very nicely.

CONCLUSIONS

The comments I have made in this letter are intended to make a number of points in response to this report by the ISG and can be summarized as follows.

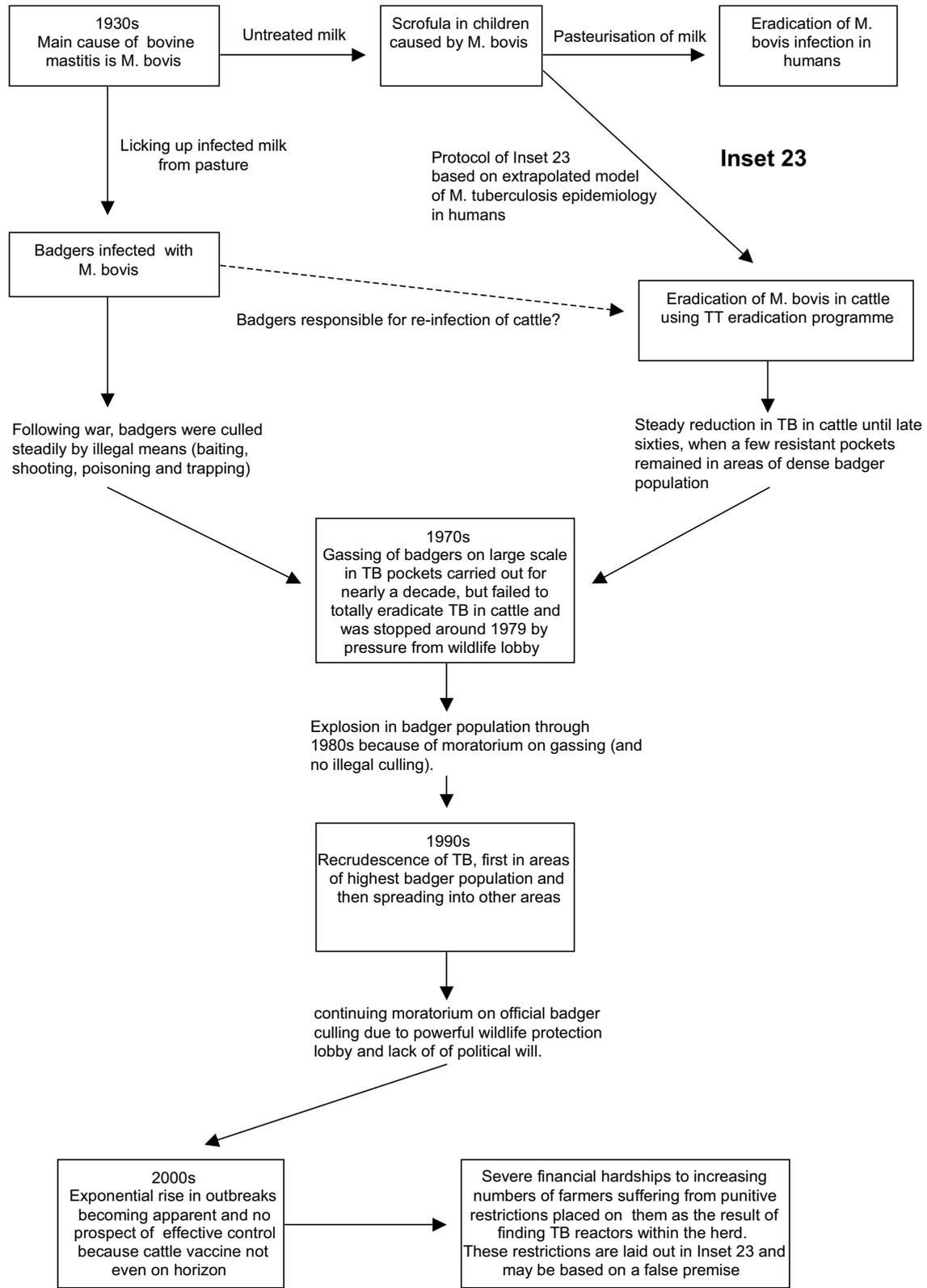
1. The true independence of this report is in question.
2. The deductions made from the statistical data have a whiff of political expedience.
3. There is no progress whatsoever in understanding the true pathogenesis of *M bovis*.
4. There is no indication that any veterinary thought from a clinical point of view has been applied to the problem of epidemiology as a whole. Viz. i) The construction of the trial took little notice of the available history from the seventies and eighties. ie that reducing the badger population sufficiently did markedly reduce the incidence of cattle TB. ii) That the assumption that the transmission of *M bovis* in cattle mirrors that of *M tuberculosis* in humans may actually be flawed.
5. The whole exercise was an expensive delaying tactic to avoid doing anything until a vaccine is available.

For good measure I have enclosed further copies of the documents I handed to you when I first came to see you in 2004.¹ Reading through them again nothing seems to have changed.

August 2007

¹ Not printed.

Epidemiological considerations of *Mycobacterium bovis*



RATIONAL BEHIND PROTOCOL OF INSET 23

1. *M. bovis* was a zoonosis as evidenced by Scrofula and may also cause disease in humans by other routes of infection, particularly as it is frequently found in the respiratory tract of cattle. It should also be kept out of the food chain by preventing infected cattle to be slaughtered for human consumption.

2. *M. bovis* in cattle was made notifiable and the legislation encapsulated by Inset 23.

3. What were the premises on which Inset 23 was based?

4. *M. tuberculosis* was a serious and at the time an ultimately fatal disease of the human respiratory tract and as *M. bovis* was also found in the respiratory tract of cattle it might cause a similar respiratory disease in humans.

5. Inset 23 therefore, was written primarily on the assumption that *M. bovis* spread from cattle to cattle via the respiratory tract just like *M. tuberculosis* in humans. This led to the legislation being written some 60 years ago and left unchanged and unchallenged to the present day. The result is that within the farming industry of the 21st century this legislation has become excessively restrictive and financially punitive to farms with discovered cases of TB. In my view the original grounds on which the legislation was based were, and still are, spurious and should be challenged.

REASONS FOR REJECTING VALIDITY OF INSET 23 PROTOCOL

1. Assumption made in paragraph 4 above is totally flawed for the following reasons:

- a) Anecdotal evidence from cases I dealt with on Powys farms in the early 90s, where despite close contact between open cases and other susceptible animals, no infection developed in respiratory tracts of any of the susceptible animals.
- b) Accepting that infected badgers contaminate grass of grazing cattle and cattle are primarily infected by ingestion there is a very simple and satisfactory explanation why cattle so often have infection in their respiratory tracts. It is due to their idiosyncratic grooming behaviour. Cattle are the only domestic species to push their tongues up their nostrils as part of their grooming process. What better way to introduce infection from the alimentary to the respiratory tract? An infected tongue would act just like a bacterial swab.
- c) Investigation of the records of human TB infection notified over the decade preceding 1995 showed that each year there were about 2000 cases of TB. Of these around 80% were due to *M. tuberculosis* and around 18–19.5 % due to numerous exotic species. Only 0.5–2% were caused by *M. bovis*. Further investigation of this group revealed that most confirmed cases were found in immigrants from countries where the consumption of non-pasteurised milk was the norm.

PROBLEMS ASSOCIATED WITH EFFECTING CHANGE

1. Government policy is the distillation of multifarious inputs, but in this sort of instance veterinary advice from the State Veterinary Service would be weighed heavily.

2. Inset 23 is under the jurisdiction of the State Veterinary Service within DEFRA and to advise change would require a clinical veterinary approach rather than that of dogma. In my extensive experience of veterinary surgeons in the SVS they are not able to adopt a clinical approach, simply because of minimal “hands on” clinical experience. They are merely civil servants with a veterinary degree and as such are a totally different animal. They would not be sympathetic to any change in the dogma of Inset 23 without irrefutable evidence that it is flawed. My experience is that such a clinically persuasive and simple explanation for the specious grounds on which Inset 23 is based would be dismissed out of hand.

3. Acceptable irrefutable evidence to support my clinically based hypothesis could only be obtained by suitable research both at field level and also by looking critically at the epidemiology of recorded outbreaks. Unfortunately, in the present political climate funding for this type of research may prove very hard to find.

4. Such research, I am sure, would turn up enough confirmation of my theory to allow at least a “risk analysis” approach to be applied to the protocol of Inset 23, rather than the draconian punitive measures that are employed at present. In my opinion, provided there are adequate safeguards retained to prevent the presentation of infected animals at slaughterhouses the restrictive measures could be considerably eased to the enormous benefit of large numbers of farmers present and future.

5. \$64,000 question; how best could an official reconsideration of the propriety of Inset 23 be effected? Is there a route on which to build a successful lobby?

2. Letter dated 16 October 2007 from Former Veterinary Officers, State Veterinary Service

BOVINE TUBERCULOSIS AND THE INDEPENDENT SCIENTIFIC GROUP'S FINAL REPORT

Lord Rooker suggested we pass to you our correspondence with him on the above topic, as enclosed.²

We are a group of former Veterinary Officers from State Veterinary Service with first hand experience of the investigation and control of TB in both badgers and cattle over many years and we are greatly troubled by some of the assertions made in the above report, on what from our experience is flawed basic data.

We have very real concerns that the EFRA Committee has not had the opportunity to hear some of the basic facts of the nature of tuberculosis in both badgers and cattle which are highly germane to this problem and the development of policy. This is certainly the case from the notes of the proceedings we have seen.

We would value the opportunity to discuss this with the Committee in person.

Dr J Gallagher, former Senior Veterinary Investigation Officer, Devon and Cornwall, former Independent Consultant to DEFRA TB Research Division.

R M Q Sainsbury, former Specialist TB Veterinary Officer, Truro.

A T Turnbull, former Head Notifiable Diseases Section, Tolworth, former Veterinary Advisor to Krebs TB Review Group.

3. Memorandum submitted by Former Veterinary Officers, State Veterinary Service

Further to my letters of 16 October and 6 November³ I enclose a summary of what we would like to present to the Committee.

We are concerned that a number of the assertions put forward by the ISG whilst theoretically feasible are in fact implausible in the light of field experience of the realities of this problem.

In this context we would like to elaborate on three main areas namely:

1. The nature of TB in the badger.
2. Cattle to cattle transmission.
3. The culling efficiency of the RBCT.

THE NATURE OF TB IN BADGERS

1. Tuberculosis has a different manifestation in most species. In the badger it is fundamentally different from TB in cattle essentially due to the lack of development of a hypersensitivity response which is a prime feature of infection in cattle. Thus small numbers of organisms infecting cattle produce a vigorous cellular response which results in extensive cell death and the development of large cold abscesses in the affected tissues usually the lung and respiratory lymph nodes. This is in fact the host immune reaction to TB. Whilst causing disease and disruption to the affected organs the changes inside these abscesses strongly inhibit the TB bacteria and kill many of them.

The badger does not show such a vigorous destructive reaction but rather a slowly progressive proliferative reaction which eventually results in cell death as numbers of bacteria increase markedly. TB lesions are thus relatively much smaller but contain relatively vastly more bacteria than those of cattle. TB bacteria do not produce toxins but rather cause lesions as a result of their highly antigenic cell walls to which different hosts may respond with greater or lesser aggression.

PROGRESSION OF INFECTION

2. Once a badger develops disease all the members of that social group are likely to become infected due to the confined living space in their underground tunnel systems, their highly gregarious nature and constant mutual grooming. But that seed of infection (the primary focus) will usually only progress to produce disease and eventually death in a minority of cases. Latency is a feature of TB in many species and this is so in badgers and cattle. The bulk of infections in badgers, usually 70% or more will become latent or dormant. A small number of badgers may resolve the infection completely and self cure. But the latent infections remain fully viable and may breakdown under stress which may be of nutritional origin, intercurrent disease, senile deterioration or social disturbance and disruption. Some badgers may develop fulminating disease (Gallagher et al 1998).

² Not printed.

³ Not printed.

Badgers with terminal generalised tuberculosis can excrete vast numbers of bacteria particularly when the kidneys are infected. Counts of several million bacteria in a full urination have been recorded (Gallagher and Clifton-Hadley, 2000).

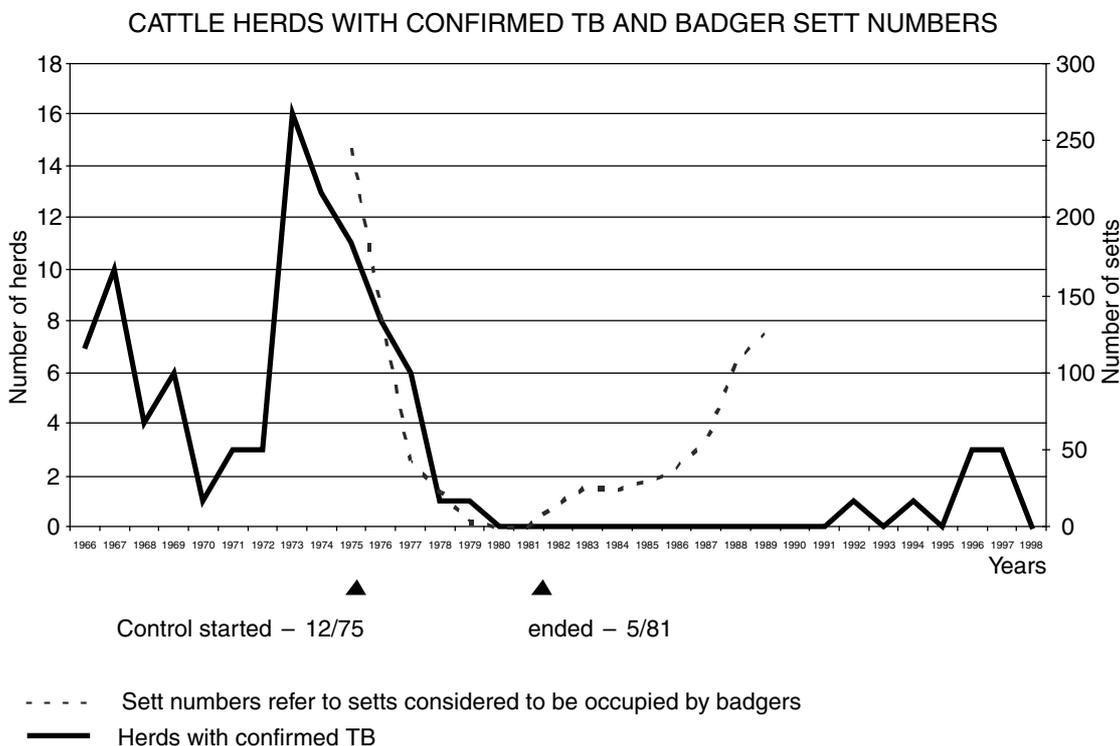
When infection is acquired by a bite wound from the contaminated mouth of another badger, the bacteria are inoculated either deeply subcutaneously or intramuscularly and rapid generalisation of infection usually occurs, causing progression to severe and often fatal tuberculosis which may develop in a matter of several months (Gallagher and Nelson, 1979). Respiratory origin infections have a longer duration and cases in an endemically infected population (Woodchester) have been monitored showing intermittent excretion of infection for a year, with the longest recorded case excreting for almost three years before death.

The above ground mortality due to TB is estimated as about 2% of the population per annum. Thus in the South West alone with its now extensive endemically infected areas the annual deaths due to TB will be of the order of at least 1000 to 2000.

Tuberculosis has an unfettered progress in the badger population and the cycle of infection and disease in the badger has long been known to be self sustaining (Zuckerman 1980). Over time the badger has become well adapted as a primary reservoir host of bovine TB infection.

TRANSMISSION OF INFECTION TO CATTLE

3. The Thornbury Trial, Gloucestershire was set up with the agreement of the then Nature Conservancy and MAFF to test the hypothesis that infected badgers were spreading TB to cattle. Complete social groups were removed from the trial area by gassing of setts whilst routine tuberculin testing of cattle herds continued. Results are shown below.

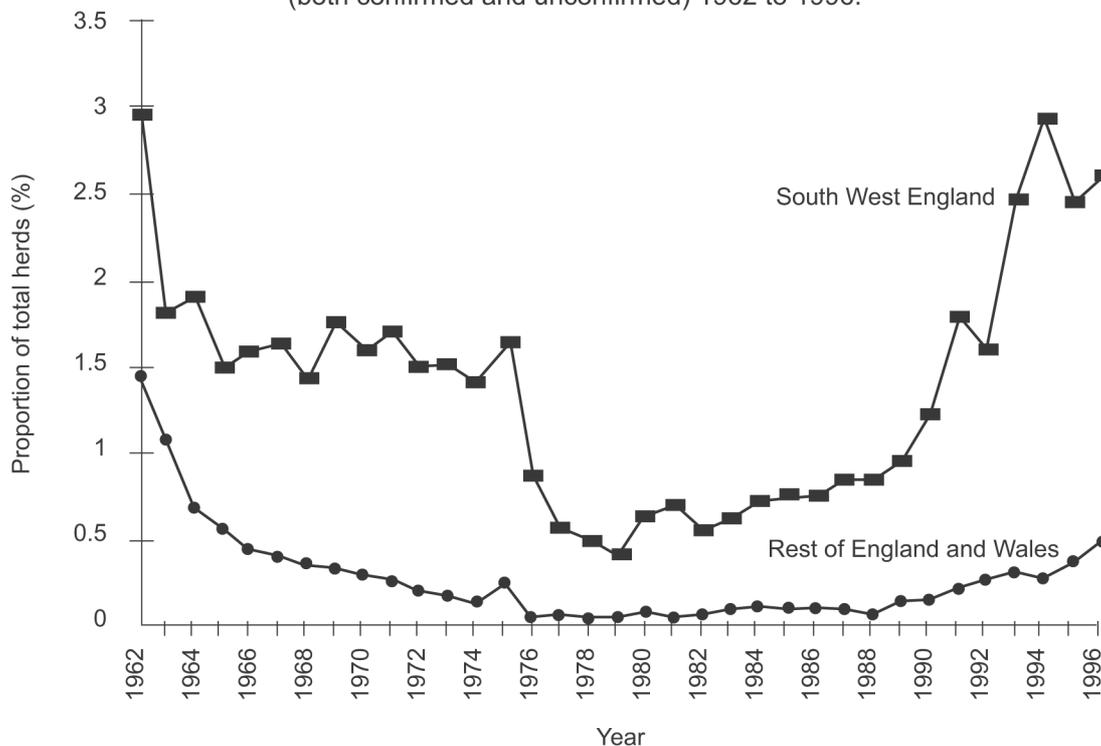


The trial area was 104 km² with 158 farms and over 12,000 cattle. Complete cessation of new cases of TB in cattle indicated that in this area all infections had been of badger origin.

This trial was replicated in Steeple Leaze, Dorset by staff at CVL (now VLA) where again complete cessation of new cases resulted, implying badgers were the sole source of infections there. This effect lasted seven years as thereafter the farms switched to arable production so whilst the duration of the effect may have been longer this could not be determined.

Whilst these trials were progressing strategic control of badgers by gassing was being carried out in the problem areas from 1975 until 1980. In that year a moratorium was introduced during the Zuckerman review. It was restarted later that year but halted in 1981 following the review. These control actions resulted in a more than fourfold reduction in new incidents of TB in cattle herds over this period of five years as shown in the graph below (Krebs 1997).

Figure 1.1 - Proportion of total herds with reactors (both confirmed and unconfirmed) 1962 to 1996.



TRANSMISSION BETWEEN CATTLE

4. Tuberculosis of cattle can be a highly infectious disease resulting in spread within herds and movement of infected individuals has been implicated in spread of infection to other herds. But the frequency with which this occurs in the field situation remains a matter of debate. Cattle to cattle transmission is reported to be of low frequency in the field, in a review of this subject by Menzies and Neil (2000). Features of the current epidemic which are relevant to the assessment of the frequency of this mode of infection are:

- Over recent years from 40 to 55% of outbreaks involve a single reactor and 60% to 80% involve less than three reactors.
- In the majority of breakdown herds (65%) reactors are only found at the initial test
- Reactor herds are usually identified during the autumn round of testing as cattle are brought into the winter housing. Testing during the winter months usually clears the herd. But if between cattle spread occurred it would be most likely during this period of confinement in the buildings.
- Analysis of testing data during the Steeple Leaze clearance trial showed a peak of infections of the circa 600 reactor cattle which occurred in May-June whilst the cattle were at pasture (Wilesmith *et al* 1982).
- None of the 200 reactor animals removed from farms in the RBCT for bacteriological sampling were found to be shedding tubercle bacilli (Sainsbury and Gallagher, 2007).
- The distribution of different spoligotypes in the cattle population is highly clustered geographically. If cattle movements have been spreading the disease around the country then the types would be randomly distributed and this pattern would not be seen.
- The great majority of the TB isolates from cattle and badgers (and other mammalian species) in any area are the same spoligotype, indicating that infection is cycling between these species.

The ISG appear to assert that if an animal is infected it will be shedding bacteria. But this is in conflict with field experience where we have found that unless the animal has lung disease it is highly unlikely to be infectious and associated with multiple cases. This is in line with medical experience where routine tracing of contacts of patients diagnosed with TB is normally carried out only if they are sputum smear positive.

Compared with badger lesions there is a relative paucity of bacteria in cattle lesions other than in those with severe advanced disease.

Whilst the ISG consider cattle to cattle transmission the main mode of infection they do not elaborate how many of the outbreaks encountered during the RBCT were considered due to (1) movements into the herd of infected cattle, (2) to contiguous cattle contact or (3) to a badger source. Rather, they state they have assumed equal weighting to all three sources in their estimates. Yet analysis of on farm outbreak investigations prior to the start of the RBCT had shown less than 10% to be associated with cattle movements and approximately 90% considered due to a badger source (Report 1995, Clifton Hadley 1995). This also correlates more with the field trial findings at Thornbury and Steeple Leaze where all outbreaks there were associated with badgers.

The ISG note the importance of translocation of TB to other areas by movement of infected cattle. They cite the 30 outbreaks post FMD in the four year testing area of North East England where in five cases there was evidence of spread of infection to small numbers of cattle in the recipient herds. But of course this equates to no spread in 83% of these herds yet some of the moved cattle had been there for almost two years.

The ISG also express concern over the sensitivity of the tuberculin test and consider that it is not identifying significant numbers of what they assume to be infectious individuals which are fuelling the deteriorating TB epidemic. Two points need to be considered in relation to this assertion namely:

- All but two States in the EEC have either eradicated TB using this test or are in the final stages of eradication. Those two States are Britain and Ireland. Both States have a reservoir of bovine TB infection in wild badgers.
- Similar views to those of the ISG stimulated a draconian test and slaughter campaign in West Cornwall during the early 1970's using severe interpretation as standard and partial herd slaughters. After several years this was abandoned as it made no difference to the incidence of new outbreaks. A draconian approach was also adopted in Ireland by the CVO Downie in the late 1970's with the same outcome and was accordingly abandoned.

EFFICACY OF CULLING

5. Serious questions remain concerning the efficacy of the culling approach used in the RBCT which is of course fundamental to the proper conduct of a culling trial and significance of its results. Points to consider are:

- Minister's reply to a Written PQ that interference with 57% of traps had occurred and a further 12% had been stolen (*Hansard* 2003).
- Minister's reply to a Written PQ that trapping efficiency had been as low as 30% (*Hansard* 2004).
- Statement by DEFRA that culling efficacy in the RBCT was 20% to 60% (DEFRA,2005).
- Submission by a trapping team supervisor (P Caruana) to this committee that trapping approaches required by the ISG were seriously flawed (EFRACOM 2006).
- ISG Final Report data showing 5 of the crucial initial 10 proactive culls were carried out in midwinter which is well known to be the least successful time for trapping.
- Trapping was carried out for eight days on average and only once a year.
- The average annual rate for the removal of badgers was 1.8 badgers per km² with a variation from 0.7 to 2.91.
- Our local knowledge that trapping success was poor.

Poor culling efficiency would be expected to cause social disruption and dispersal (perturbation) of infected badgers most of which would have been in a state of latent infection. As discussed under 1. above stress caused by such disruption is likely to cause latent infections to become activated and may produce fulminating disease. Culling rationally must always aim to remove the entire social group, as the infected unit. It should avoid dispersing infection to make the situation worse both in the badger population as well as for cattle and of course all other species sharing the badger's habitat.

It is noteworthy that cage trapping was used in the Hartland, Devon control exercise in 1984 and resulted in a fall in confirmed herd outbreaks in cattle from 15% to 4% in 1985 (Krebs 1987). Thereafter annual incidence declined and held at around 1% for nearly 10 years. In excess of 80% to almost 90% of badgers were removed which required protracted trapping efforts in some of the area. In some difficult parts trapping continued for up to three months. The area involved was 62 km² and no so called edge effect was seen during or after this removal.

Dr J Gallagher, former Senior Veterinary Investigation Officer, Devon and Cornwall, former Independent Consultant to DEFRA TB Research Division.

R M Q Sainsbury, former Specialist TB Veterinary Officer, Truro.

A T Turnbull, former Head Notifiable Diseases Section, Tolworth, former Veterinary Advisor to Krebs TB Review Group.

November 2007

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4. Memorandum submitted by the Department of Environment, Food and Rural Affairs

Please find attached statistics on TB incidence in Great Britain (Annex A). Information is provided on the counties which have the highest level of bovine TB in 1997 and 2006, and which had RBCT triplets in their areas. We had hoped to provide statistics on bovine TB incidence in specific triplet areas before and after culling operations, but unfortunately this has not been possible in the time available.

For context Annex B shows the National Statistics chart for the incidence of bovine TB in Great Britain over ten years, calculated as the percentage of unrestricted herds experiencing a confirmed breakdown (a herd disclosing reactors to the skin test at a routine test).

As the Committee asked about how the triplets were selected Annex C is provided for interest. It is a Standard Operating Procedure from the RBCT which outlines the way in which trial areas were selected for inclusion in the trial, and how their borders were defined.

December 2007

CONFIRMED TB INCIDENCE IN “HIGH INCIDENCE” COUNTIES: 1997 AND 2006

The headline TB herd statistic for Great Britain is TB incidence, defined as confirmed new incidents as a percentage of tests on unrestricted herds.

This figure is reported in Defra’s National Statistics on bovine TB, which includes a graph showing the incidence of TB since 1996. This graph is included as Annex B.

The tables below provide a breakdown of TB herd incidence for the worst affected counties across GB in 1997 (ie pre-RBCT) and 2006 (post-RBCT).

For the purpose of this document, “high incidence” counties include all those with a TB incidence equal to or higher than the national average for GB. Counties involved in the Randomised Badger Culling Trial (RBCT) are shown in italics.⁴

1997 TB INCIDENCE

Data downloaded from Defra’s Animal database Vetnet in the week commencing 3 December 2007.

<i>Worst affected counties in GB⁵</i>		<i>TB incidence⁶</i>
1	<i>Gloucestershire</i>	6.0%
2	<i>Hereford and Worcester</i>	5.8%
3	Gwent	3.9%
4	<i>Staffordshire</i>	3.2%
5	<i>Wiltshire</i>	3.0%
6	Dorset	2.8%
7	<i>Somerset</i>	2.3%
8	<i>Devon</i>	2.2%
9	<i>Cornwall</i>	1.8%
10	<i>Avon</i>	1.5%
GB	Great Britain	1.5%
—	<i>Derbyshire</i>	0.0%

2006 TB INCIDENCE

Data downloaded from Defra’s Animal database Vetnet in the week commencing 3 December 2007.

Worst affected counties in GB		TB incidence ⁷
1	<i>Hereford and Worcester</i>	9.9% (7.5%)
2	<i>Gloucestershire</i>	9.9% (7.3%)
3	Gwent	6.8% (5.0%)
4	<i>Devon</i>	6.5% (4.4%)
5	Powys	5.4% (3.3%)
6	<i>Cornwall</i>	5.2% (3.7%)
7	<i>Avon</i>	4.9% (3.4%)
8	Shropshire	4.9% (3.0%)
9	<i>Wiltshire</i>	4.6% (3.3%)
10	<i>Derbyshire</i>	4.1% (2.6%)
11	<i>Staffordshire</i>	3.9% (2.6%)
12	Dyfed	3.8% (2.2%)
13	West Glamorgan	3.6% (2.7%)
GB	Great Britain	3.6% (2.6%)
14	<i>Somerset</i>	3.0% (2.1%)

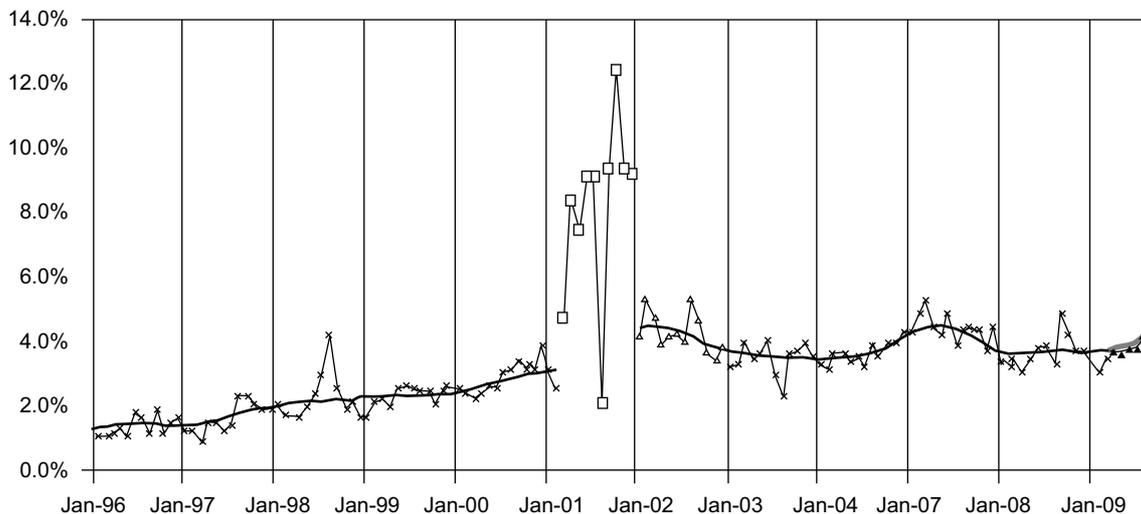
⁴ RBCT trial areas were located wholly or partly in the counties in Cornwall, Devon, Somerset, Avon, Wiltshire, Gloucestershire, Hereford and Worcester, Staffordshire and Derbyshire.

⁵ Excludes counties with fewer than five confirmed herd incidents in the year. Derbyshire included as the county was involved in the RBCT.

⁶ Confirmed new TB herd incidents (breakdowns) as a percentage of tests on unrestricted herds.

⁷ Confirmed new TB herd incidents (breakdowns) as a percentage of tests on unrestricted herds. Figures in parentheses are the same percentage when pre-movement tests are counted in the number of tests on unrestricted herds.

TB INCIDENCE¹ IN GREAT BRITAIN: 1996–2007



- x— Percentage of tests on unrestricted herds resulting in a confirmed new incident.
- Trend (23 term henderson moving average of seasonally adjusted data.)
- Provisional trend-line.
- TB testing significantly reduced due to the Foot and Mouth Disease outbreak and targetted to higher risk areas.
- ▲— TB testing resumed in 2002 and was initially concentrated on cleaning the backlog of overdue tests.
- ▲— Provisional Data (Confirmed New Incidents).

Source: Defra's National Statistics on bovine TB.

¹ Confirmed new incidents (breakdowns) as a percentage of tests on unrestricted herds.

RANDOMISED BADGER CULLING TRIAL—STANDARD OPERATING PROCEDURE 2—SELECTION OF TRIPLETS

APPROVED BY	SIGNATORY	SIGNATURE	DATE
National Trial Manager			
Independent Scientific Group			
Head of Bovine TB and Zoonoses Division			
Head of Endemic Diseases and Zoonoses Team			

INTRODUCTION

These instructions set out the procedures for selecting candidate triplets of trial areas for inclusion in the randomised badger culling trial.

MATERIALS/DATA SOURCES

Current, validated Vetnet data on TB incidents in (a) the last 12 months and (b) the last three years, cattle holdings and numbers.

Map showing TB breakdowns and 5.64 km radius circles, of top 66 breakdown hot spots numbered sequentially.

GIS to facilitate mapping of TB incidents and cattle holdings.

Computer Program to select TB incident clusters, see Appendices 1 and 2.

DEFINITIONS

A Triplet is a group of three trial areas, each subject to a different treatment. Within each triplet, one trial area will be allocated to proactive culling, one to reactive culling and one to survey only.

A Trial area defines the cattle herds to contribute to TB breakdown data.

A Treatment area comprises the trial area plus that part of the buffer zones necessary to ensure that all setts associated with herds in the trial area receive the treatment allocated to that trial area.

TIMING

The decision to identify a new triplet or triplets (including how many and when) for enrolment into the trial shall be made by the Independent Scientific Group in the light of a recommendation from the National Trial Manager, having regard to the availability of Wildlife Unit Resources.

SELECTION CRITERIA

TB incidents

The total number of confirmed incidents is the most important factor for determining the location of trial areas. In particular:

- (i) the total number of TB incidents within a 100 km² area over the latest three years for which reliable data are available. Thus, areas with the highest TB incidence over the last three years should be considered first;
- (ii) the total number of TB incidents within a 100 km² area over the last 12 months for when reliable data are available. Thus, an area where there have been no TB incidents within the last 12 months shall not be considered for enrolment into the trial; and
- (iii) the comparative number of TB incidents (one year and three year) between the three candidate trial areas considered for enrolment as a triplet into the trial. Thus, areas where the TB incidence between the three areas which make up a triplet is similar should be preferred over those where there is a large variation.

Other factors

In addition to the absolute number of TB incidents, the following objective criteria are also taken into account:

Geographical proximity to trial areas already enrolled into the trial:

New trial areas must be positioned so that their inner and outer buffer zones do not overlap the inner buffer zones of existing trial areas. Outer buffer zones of new and existing trial areas may overlap.

Number of cattle holdings:

There must be minimum of 50 cattle holdings within any treatment area.

So far as possible, the number of cattle holdings within each candidate treatment area considered for inclusion within a triplet should be roughly equivalent.

Topography:

So far as possible, the total surface area of a treatment area should be at least 100 km².

So far as possible, the surface area of each candidate treatment area considered for inclusion within a triplet should be roughly equivalent.

So far as possible, the geographical, climatic and geological characteristics of each candidate treatment area considered for inclusion within a triplet should be roughly equivalent.

History of badger removals:

Over the 10 chosen triplets, it will be desirable for the trial to include areas where there has been no recent (within 10 years) history of badger removals in order to obtain data on the effect of culling in such areas.

Logistics:

The proximity of candidate trial areas to WLU resources has to be factored into decisions between potential candidate areas.

Natural boundaries impassable to badgers:

The location of natural boundaries impassable to badgers shall, as far as possible, be taken into account at the desk stage of defining trial area boundaries. See also SOP.

Known large areas of non-co-operation:

The presence of significant tracts of land, located within candidate trial areas where it is known that the landowner/occupier is unwilling to co-operate with the trial may affect the final positioning of the point centres and/or the boundaries of candidate trial areas but this shall be taken into account at the desk stage of defining trial area boundaries. This is also covered by separate standard operating procedures (SOP 3—Delineation of Trial Area Boundaries) but such repositioning/boundary changes may require some or all of the above criteria to be revisited.

PROCEDURES FOR APPLYING THE SELECTION CRITERIA*Preparation of base data*

At the ISG's request, VLA shall prepare a map showing the latest reliable TB incidence data as recorded on Vetnet. The map shall have plotted on it circles depicting the top 66 TB incident 100 km² hot spots, numbered in order of incidence. A table showing, for each circle, the incidents data for the most recent 12 months and 36 months, for which Vetnet data is available, shall also be provided.

Consideration of candidate circles

The Secretariat to the ISG shall arrange for the Trial Area Selection Sub-Group to meet to select candidate triplet areas. This Sub-group shall consist of:

- A representative of the ISG;
- The National Trial Manager;
- Head of VLA TB Epidemiology Section;
- (Supported by VLA staff responsible for the provision of the base data as appropriate);
- A member of the ISG Secretariat.

Reporting conclusions to the ISG

Following the Triplet Selection Sub-group's consideration of potential candidate new trial areas a paper shall be prepared for the next meeting of the ISG setting the Sub-Group's recommendations for new trial areas. This paper shall be prepared by the ISG Secretariat.

CONFIRMATION OF TRIPLET SELECTION

The decision to accept recommendations on the location of new triplets shall only be made at a quorate meeting of the full ISG. The agreement of the Chairman (Professor Bourne) and Vice Chairman (Dr Donnelly) to selected candidates shall, in any case, be necessary to confirm selection.

5. Memorandum submitted by Roger Sainsbury

For nearly 40 years I have been involved with tuberculosis, a very complex and interesting problem. For the last 32 years I have been in the Truro Animal Health Office dealing mainly with M.bovis infection in cattle and badgers. This not only included the full range of work with cattle TB—testing, breakdown investigations, post mortem examinations and overseeing the situation as Lead TB Veterinary Officer—but I have also worked on many aspects of this disease in other animals, particularly badgers. As well as post mortem work on these I was also included in the decision making and practicalities of all the badger control strategies from the beginning, and also with the implementation of the live test trial.

I was very disappointed not to have the opportunity to discuss the findings of the ISG with the EFRA Select Committee as I felt that my input might have been useful to you. In preparation for this event I had looked at some aspects of this problem which seemed relevant, and I attach a short note outlining these. I hope this will be of some use in your deliberations.

TB IN CATTLE AND BADGERS**M.BOVIS TYPING—SPOLIGOTYPING AND VNTR TYPING**

(The Irish use RFLP typing—these show the same pattern)

- There is geographical clustering of disease types (statistically valid—paper).
- Infected species in the same areas usually share the same type.

Thus, it is highly probable that infection in the different species is related.

- The striking clusters of cases would not be seen if cattle movements commonly spread this disease. These would “randomly” mix up the types.

COMPARATIVE PATHOLOGY OF TB AND INFECTION RISK DIFFER BETWEEN SPECIES

- Lesions in badgers—often found in lung and kidney.
- Infection risk is high from these (*M. bovis* can be excreted even by badgers grossly NVL)—routes: lung/kidney/liver/suppurating bite wounds/faeces/urine. Huge numbers of organisms are sometimes seen (sometimes called super excretors).
- Lesions in cattle—usually found in lymph nodes.
- Infection risk is low—lymph nodes are not usually open to the exterior. A few cattle are found with lung lesions and a very few with liver lesions. I have never seen kidney lesions. The number of organisms found in the lesions is low.
- (Pathman study unable to find organisms in sputum from reactors. Other experimental work done in Ireland is equivocal—huge artificial infective dose + young animals).

So, the probability of infected animals being infective is high in badgers, low in cattle, therefore, it is more likely that *M. bovis* will pass from badgers to cattle.

Furthermore, testing of cattle removes potentially infective cattle. No testing of badgers is carried out. Badgers can live with the infection for years with no apparent effects, suggesting badger adaptation.

CATTLE TO CATTLE TRANSMISSION IS UNCOMMON

- Usually, number of reactors at the initial reactor test are low. 60%+ of cases only have one reactor. 85%+ have three or less. Occasionally there is evidence of spread within the herd, but these cases are not common (though these are the ones people remember).

As would be expected from the pathology, therefore, spread within the herd is fairly rare.

- Spread over the hedge to contiguous herds would also be expected to be low, as above. Often apparently contiguous herds are not actually contiguous or cattle not been in contiguous fields. Or, if lesions were found next door, none were considered to be open.
- TB epidemiological investigations have found that around 85% are considered to be of badger/wildlife (probably badger) origin. Only 10% were purchase origins, and 5% contiguous spread.
- In the 1997–98 study, some apparent purchase origins discovered by investigations were not supported by the subsequent *M. bovis* typing. Even housed badgers are of risk from badgers getting into buildings.

PRACTICALLY, THE CATTLE TUBERCULIN TEST DOES NOT SEEM TO MISS INFECTION

- The SICC is not used in isolation in cattle herds. If reactors are found tests are carried out every 60 days.
- Meat inspection does not turn up a significant number of potential TB reservoir cattle. These would have to have open lesions, and tracing back to their herds of origins should discover that these have had TB problems. Lesions in slaughterhouse cases have a very similar distribution to those found in reactors. The origin herds quite often have no further reactors (much to the disgust of the farmers who suspect we have the wrong herd). The ISG report provides no evidence for these.

INCREASED CATTLE CONTROLS

- Are what we are left with according to the ISG.
- This approach has been tried before, with no discernable effect on TB in cattle by:
 - William Tait, Cornwall, early 70s,
 - Downey, Ireland, ERAD, 1978.

ALSO, FROM TB CATTLE HERD DISTRIBUTION AND THEIR TYPING

- Several groups of infected herds have been found well away from the south and west after a long period of freedom from cattle TB. Examples—Cumbria, Stafford/Salop/Derby, Brighton.
- These are novel Spoligo/VNTR types, not from longstanding TB areas of S and W.
- Spread not possible in the time available (Stafford/Salop/Derby) for it to be cattle spread.
- “Spread” of TB up Cornwall in the early 80s was not what it appeared—the spoligotyped are different as you go east.

CULLING APPROACH

- Trapping success rate—low in ISG's trial—8 days a year cannot be anything else.
- Effect on the disease in cattle surprisingly high considering the few days spent in trapping.
- Previous culling has been far more intensive—removing until no sett activity (stick in entrance). Expensive—so is removing large numbers of reactors and DCs. Good investment.
- If edge effect is an artefact, then there is no barrier to intensive smaller removals. There must be carried out quickly (previously long delays).

EDGE EFFECT

- Not noticed in previous removal strategies (may be able to find some figures). Would have been very obvious in small removals. Particularly during gassing.

Disease cases in cattle and badgers highly clustered. Area cutting across developing cluster would give new cases just outside area. Maps could not (of course) be published, but discussions with local animal health staff might be helpful.

GENERAL ASPECTS

In looking at this problem clinical observation and investigation, which are of great importance in the veterinary and medical sciences must not be forgotten. There is often no possibility of controlled experiments in these fields, and these tend to be the exception rather than the rule. Clinical observation and investigation therefore make up much of the scientific body of work and cannot be ignored.

The SVS are an organisation primarily involved in disease control; they are not a research organisation. There have been no resources available for writing up and publishing the results of analyses of the huge quantity of TB data that has been amassed during the TB schemes in peer-reviewed journals. Reports written, of course, but these are internal and are not generally published.

The approach to this disease was initially very similar to other diseases which we have controlled nationally—slaughter of infected animals and dangerous contacts, and biosecurity. *M.bovis* is, however, fundamentally different from FMD or brucellosis, this was discovered in the early 70s in Gloucestershire (it is more like bluetongue).

Molecular geneticists have looked at the ancestry of *M.bovis*—strains found in badgers appear to have evolved from cattle strains (no longer found in the wild in the UK). Cattle act as sentinels for these *M.bovis* strains—which seem to grow better in badgers than cattle. The ISG seemed unaware of the possibility of *M.bovis* in badgers being badger-adapted, endemic and the chief reservoir. Their recommendation, that we should return to the traditional disease control policies which have already failed us, should not be implemented. The current cattle controls are sufficient to deal with the cattle disease, but this will continue if the source of infection is not reduced.

CONCLUSION

- ISG work has confirmed the link between TB in badgers and cattle.
- Badger culling was surprisingly effective in the areas.
- It is very likely that most cattle disease originates from badgers.
- A cattle reservoir and spread by cattle movements are unlikely. The reservoir is in badgers.
- Increased cattle controls are unlikely to be successful in reducing the disease.

In 10 years when thousands more cattle have died and the cattle industry has been seriously damaged to no purpose, I do not want to have stood by and said nothing.

December 2007

6. Memorandum submitted by the Institute of Ecology and Environmental Management

BOVINE TUBERCULOSIS IN CATTLE AND BADGERS

I write on behalf of the Institute of Ecology and Environmental Management (IEEM) in response to the paper produced by Sir David King.

The IEEM is the body that represents professional ecologists, both in the UK and abroad. It has over 3,000 members spanning the public, private and voluntary sectors. It is a constituent body of The Society for the Environment and many IEEM members have Chartered status. Several of its members are also actively involved in farming.

The IEEM Memorandum of Association has a number of objects, which include:

- to advance the science and practice of ecology and environmental management for the public benefit in the United Kingdom and internationally;
- to further the conservation and enhancement of biodiversity and maintenance of ecological processes and life support systems essential to a fully functional biosphere;
- to further environmentally sustainable management and development;
- to promote and encourage education, training, study and research in the science and practice of ecology, environmental management and sustainable development; and
- to establish, uphold and advance the standards of education, qualification, competence and conduct of those who practice ecology and environmental management as a profession and for the benefit of the public.

The Institute recognises fully that disaggregating the scientific evidence surrounding the issue of TB, badgers and cattle is no easy task, and that the paper put forward may go some way in achieving this.

However, it remains starkly clear that insufficient consideration has been given to the broader ecological impact of large-scale eradication of a native mammal from our ecological system. Such an approach could not be condoned by the Institute since it is in clear conflict with several of our objectives, listed above. It is standard practice for an environmental impact assessment to be undertaken in similar situations, especially involving protected species and even on a far smaller scale. The IEEM objectives stress the need for an evidence-based approach in reaching conclusions on such matters. Only when the consequences and residual effects are fully understood should any consideration be given to undertaking such action.

Indeed, there would also need to be far greater consideration of the practicalities and cost-benefit of such an operation, as well as the likelihood of it achieving the desired end result. The Institute believes that a more appropriate approach would involve undertaking further research on the control of TB within both cattle and badgers by means other than an attempt at wholesale eradication.

Consequently, without such an assessment in place and consideration of available research options, the Institute strongly objects to any large-scale cull of badgers in the UK.

We trust that these observations are of assistance and would, of course, be happy to advise further if required.

December 2007

7. Letter dated 12 November 2007, from D W Yalden, President, The Mammal Society

The 1997 Krebs Report concluded that, despite 15 or more years of badger culling in Great Britain, it was still uncertain whether this was effective because no proper scientific experiment had been conducted. As a result, the government, in the form then of MAFF (now of DEFRA) commissioned an extensive, rigorous 10 year experiment (the RBCT—the Randomised Badger Culling Trial). Ten triplets, each one containing a control area (no culling), a proactive area (culling as many badgers as possible) and a reactive area (culling badgers only in response to cases of TB in cattle local to the badger setts), each of roughly 100 km², were investigated over a rolling five-year period between 1998 and 2004. Professional trappers were employed to survey each area, set cage traps and kill the badgers. A team of research scientists, the ISG (Independent Science Group), including ecologists, veterinarians and statisticians, oversaw the project, independent of the team actually carrying out the experiment. Their work has been published as the experiment has proceeded to completion, in an important series of highly rated scientific papers, peer-reviewed and published in leading journals. They demonstrate very clearly how many badgers were killed, how many cases of tuberculosis there were in badgers and cattle in those areas, how many badgers were culled in all three sorts of area (control, reactive, proactive). They also investigated the efficiency of the programme, in terms of culling badgers, reducing cases in cattle, and the costs of achieving that reduction. They reach the very clear conclusion that badger culling cannot meaningfully contribute to the long-term control of bovine TB in Britain. Sir David King, as Chief Scientist, has reached a different conclusion, on the basis of the same evidence, and claims to offer the Government better, different, scientific advice on how it should proceed.

The Mammal Society comprises a free assembly of members, amateur and professional, whose interests cover the full range of academic and practical mammalogy. Many are ecologists, but that encompasses a full range from conservationists at one end to pest controllers at the other. We are anxious, as a Society, to see the fullest possible range of British mammals thriving in the country, but are not in principle opposed to culling, where it can be shown to be effective (for example, of mink on Lewis to protect ground-nesting birds, or elsewhere to protect water voles). We boast that we try to offer the best scientific advice in contentious cases. Clearly, what we have in the case of badgers, bovine TB and culling is a conflict of scientific advice. In these circumstances, we clearly should offer our advice.

At the heart of Sir David's case is his contention that thinning out the number of badgers would reduce the chances of them passing TB to cattle. Yes, of course. The intention of the RBCT was to find out by how much. Sir David himself quotes the answer: averaged over the ten trial areas, and at the heart of the proactive control areas, about 30%. Put another way, he advocates a substantial cull of badgers in order to achieve, if he is lucky, only a 30% reduction of the cases of TB in cattle.

So how is it proposed that the other 70% of cases, the considerable majority, be controlled? He is himself aware in part of the other major contribution to new cases of TB in cattle—cattle movements. Referring to the important paper in *Nature* on this topic, (Gilbert *et al* 2006), he acknowledges that new cases of TB in cattle at a long distance from the known hot-spots in SW Britain are probably the consequence of livestock transport. He then makes the extraordinary assertion that the other main pattern of increase in cattle TB cases, the expansion in intensity and extent of cases around those hot-spots, is entirely due to badgers. Has he evidence that there are no local movements of cattle contributing to these increases? He must be aware that with TB in Ireland, as indeed during the recent and earlier Foot-and-Mouth outbreaks, farms that occupy multiple sites (split holdings) are considered a major risk. He also seems to be unaware, certainly fails to acknowledge, that the routine TB testing of cattle is not 100% reliable. About 5% of cattle which test negative are actually carrying TB, and therefore, since they are not culled, survive to re-infect the herd, or reveal themselves as positive, at a later date (The converse also applies: some cattle that test positive, and are culled, turn out at post-mortem not to be infected). Clearly, this unreliability, combined with local and more distant cattle movements, has a part to play in maintaining and spreading TB in cattle. How much was not part of the subject of the RBCT, nor the ISG's remit. Clearly, controlling these movements must play a large role in controlling the incidence of TB in cattle. There must be a suspicion that extra movements following BSE and Foot-and-Mouth as farms restocked played a large part in precipitating the recent upsurge, but we acknowledge that this is a speculation, not a scientific fact.

Sir David speculates that if the areas of badger control were expanded to perhaps 300 km², culling might be more efficient, because the peripheral area, where cases of TB in cattle apparently increased in reaction to badger culling (the now accepted perturbation effect), would be proportionately smaller. He provides absolutely no evidence that this would in fact be possible or practicable. If the trapping were to be less effective, because it would be spread more thinly over a larger area, its effectiveness would be much reduced. Sir David has no more evidence for his case than we would have for this last speculation. There is simply none available. Whistling in the dark is a poor basis for offering the government scientific advice.

This argument highlights the weakest point of Sir David's report. He says that he will not discuss the economic basis of his proposed advice. That is to ignore a major segment, and a critical one, of the ISG's report. Just as was found by the Dunnet report over 20 years ago, the economics of culling badgers make no sense. It would cost far more to cull each badger than the value of any cattle saved. Even more economically efficient methods of culling badgers (a return, for instance, to gassing) are not thought likely to overturn the economic arguments, and certainly Sir David does not address this aspect at all.

Sir David's report was also extremely weak in considering the practicality of any proposed cull. Again, the RBCT provided much relevant information, though he appears not to acknowledge its relevance. He is dismissive of some of this, reporting that the reduction of badgers in the proactive areas was only determined by indirect evidence (signs: presumably he meant rates of occupation of setts). In fact, the densities of badgers in culled and control areas were compared by using road transects at night, and the numbers culled were known precisely. They were used to estimate trapping efficiency by comparing the numbers trapped on the first occasion with those trapped in total over the five years of culling in each triplet. For seven of the 10 trials, proactive culling removed about 70% of the badgers present. However, in three of the trials, the trapping was less effective, around 30–35%. Why? In some cases because trapping in winter was less effective than trapping when badgers are more active, but in one, at least, because of interference from people opposed to the culling programmes, and the refusal of landowners to allow trapping to take place on their land. Sir David implies that these were small pockets, which could be dealt with by trapping round their margins. Practical advice must acknowledge that these effects could be magnified in a more extensive, and even more contentious, culling programme. This possibility is not even mentioned.

One might have expected dispassionate scientific advice to draw on evidence from elsewhere. Sir David acknowledges that the Irish Four Areas trial also demonstrates some reduction in the incidence of TB in cattle in four areas where badgers have been culled (more severely than in Great Britain, and using snares which we would consider illegal). He does not quote their scientific team's conclusion that badger culling has no worthwhile long-term role to play in the control of the disease in cattle. Nor does he draw on the experience of Northern Ireland, where no badger culling has taken place, but where TB in cattle is if anything under rather better control than in Great Britain.

In short, there seems to The Mammal Society to be no serious comparison in the value of the scientific advice offered, on the one hand, by the ISG, and on the other, by Sir David King. He adduces few serious arguments, no evidence, no improved analysis, that in any way casts serious doubts on the conclusions reached by ISG. Unless he can do so, his weak advice should be ignored.

Letter dated 22 January 2008, from The National Trust

Our Trustees met last week, and considered the National Trust's position should the government authorise any form of badger culling in an attempt to control Bovine TB (BtB) in cattle.

Our position on the overall link between badgers and BtB in cattle is clear. We are not against the culling of badgers *per se*, but the purpose needs to be clear and the measure effective. In 1997, we supported the Randomised Badger Culling Trial as overseen by the Independent Scientific Group. We now accept its findings, as published in peer-reviewed scientific papers, that whilst badgers are part of the problem culling them is unlikely to make a major contribution to the reduction of BtB in cattle.

We firmly believe that any significant decrease in BtB in cattle could only be achieved through such large scale and draconian measures to reduce badger numbers as to make the option impractical, unaffordable and publicly unacceptable. Even then it would only reduce the problem by around 20%. Any badger control measures that would be less comprehensive than that, such as a voluntary, unfunded approach, would have even less effect. Indeed, as the science suggests, culling could even increase BtB in cattle through the perturbation effect.

It seems that the greater part of the problem relates to cattle to cattle transmission of the disease and there are signs that good control of cattle movements and pre-movement testing can make a much greater difference than culling of badgers. For example, the dramatic reduction in BtB in cattle in Northern Ireland has been achieved by a combination of pre-movement testing and a well regulated system for cattle movements, rather than badger culling. We would encourage the Government to think of ways in which these critical processes can be financially supported in BtB hotspot areas throughout the UK.

Our response towards any officially-licensed badger cull would therefore be consistent with the above position.

I am sorry that our reply has been delayed but we felt it was very important for our Trustees to give careful consideration to such an important issue.

Sir William Proby Bt
Chairman
