

The Government's policy on Bovine TB and badger control in England

December 2011

© Crown copyright 2011

You may re-use this information (not including logos) free of charge in any format or medium, under the terms of the Open Government Licence. To view this licence, visit www.nationalarchives.gov.uk/doc/open-government-licence/ or write to the Information Policy Team, The National Archives, Kew, London TW9 4DU, or e-mail: psi@nationalarchives.gsi.gov.uk

This document/publication is also available on our website at:
www.defra.gov.uk/publications/2011/12/14/pb13691-bovine-tb-badger-control/

PB 13691

Contents

1. Introduction	1
2. Why is action needed to tackle TB in badgers?	2
3. Options considered	5
Biosecurity	5
Badger Vaccination	6
Badger Culling	9
Future control tools	11
Conclusion	12
4. The Impact of Culling	13
Impact on the incidence of TB in cattle	13
Impact on the badger population	15
Economic impacts	15
Ecological impacts	17
Impact on public safety and security	18
Is culling a proportionate response?	18
5. The Policy	19
Licence conditions for culling	20
Other considerations	31
Vaccination	33
6. Monitoring and Policy Evaluation	34
7. Conclusion	36
References	37

1. Introduction

1.1. Bovine TB is the most pressing animal health problem in England. The annual number (and incidence) of herds infected with TB in England has been on a slowly rising trend for some 25 years. The area affected by bovine TB has spread from a few isolated pockets in the late 1980s to cover large areas of the West and South West of England and Wales. During 2010, 10.8% of herds in England were under movement restrictions due to a TB incident at some point during the year, while in the West and South West this figure was 22.7%. In 2010 in England there were 8.2 new TB breakdowns¹ for every 100 tests carried out in unrestricted herds and nearly 25,000 cattle were slaughtered for bovine TB control purposes.

1.2. It is estimated that the average cost of a confirmed TB breakdown in cattle is around £30,000. About £20,000 of this falls to Government, mainly in compensation for animals compulsorily slaughtered and costs of testing. This leaves about £10,000 in costs to farmers from losses of animals, farm costs of testing, and disruption to business through movement restrictions. The cost to the taxpayer is set to top £1 billion over the next ten years.

1.3. There are a number of reasons why the Government intervenes to tackle bovine TB, including to:

- protect the health of the public and maintain public confidence in the safety products entering the food chain;
- protect and promote the health and welfare of animals;
- meet our international (in particular EU) and domestic legal commitments, and maintain the UK's reputation for safe and high quality food;
- maintain productive and sustainable beef and dairy sectors in England by securing opportunities for international trade and minimising environmental impacts; and
- reduce the cost of TB to taxpayers.

1.4. The Government is committed to ensuring we have a comprehensive and balanced package of measures to tackle bovine TB, with eradication as the ultimate, long-term goal. The TB Eradication Programme for England¹, published on 19th July 2011, describes the package of measures that we are deploying to tackle TB. We already

¹ From January 2011 we have used the term Officially TB Free Status Withdrawn (OTF-W) in place of Confirmed Herd or TB Breakdown (CHB) to better align our terminology with European legislation which sets out the requirements for TB controls. In England, a cattle herd is classified as OTF-W where lesions typical of TB are detected at post-mortem examination of one or more TB test reactors and/or *Mycobacterium bovis* is identified in tissue samples from any animal in that herd. Cattle herds that are placed under movement restrictions for any other TB-related reason are designated Officially TB Free Status Suspended (OTF-S). However, in this document we will continue to use the term 'Confirmed' in line with how data on cattle TB incidence are described in the available evidence base.

have a robust set of measures in place to tackle transmission between cattle and, while we are committed to maintaining these controls (and strengthening them where it makes sense to do so), it is clear that cattle-based control measures alone are not working in the West and South-west of England where we know the disease in cattle is perpetuated through spread from an infected badger population.

- 1.5. The Government has therefore committed to introduce, as part of a package of measures, a carefully managed and science-led policy of badger control in areas with high incidence of TB in cattle. Following a public consultation in 2010 and a consultation of key stakeholders on draft Guidance to Natural England between July-September 2011, the Government has now decided to proceed with a policy of enabling farmers and landowners to cull and/or vaccinate badgers, under licence, in areas of high incidence of TB in cattle.
- 1.6. This document explains the reasons why it is necessary to tackle the reservoir of TB infection in badgers; the other options that have been considered; the benefits that we could expect culling to achieve and the rationale for the licence conditions that will be imposed to ensure these benefits are realised.

2. Why is action needed to tackle TB in badgers?

- 2.1. The incidence of TB herd breakdowns in England has been rising for the last 25 years. There was a marked increase in bovine TB incidence across Great Britain in the wake of the Foot and Mouth Disease outbreak of 2001 and the suspension of the TB herd testing programme that ensued for most of that year. The herd incidence fell in 2003, but it has since then resumed its slowly rising, if cyclical, trend (Figure 1).
- 2.2. While the rate of increase in the number of new TB herd breakdowns detected year-on-year has slowed down since 2003², the incidence of bovine TB in England is still on a gradual long-term upward trend and is unacceptably high by comparison with the majority of developed countries. In 2010 there was an increase in the number of new TB herd breakdowns in England compared with 2009 (Figure 2). Although this was lower than the peak reached in 2008, it suggests that the disease situation may be worsening again. The provisional TB statistics for England suggest that in 2011 we will experience another small rise in the number of new TB herd breakdowns disclosed relative to the previous year.

² Since 2003 the total number of new bTB herd breakdowns identified (every quarter) in GB has been doubling every 10 years. Prior to the Foot and Mouth Disease epidemic of 2001, the rate at which the number doubled was every 5.2 years. This deceleration may be due to the intensification of TB surveillance and control measures in cattle herds over recent years, some form of 'saturation' in the endemic areas (as TB herd breakdowns last longer and the number of susceptible herds at risk of being newly identified as infected is decreasing over time), or a combination of these and other factors.

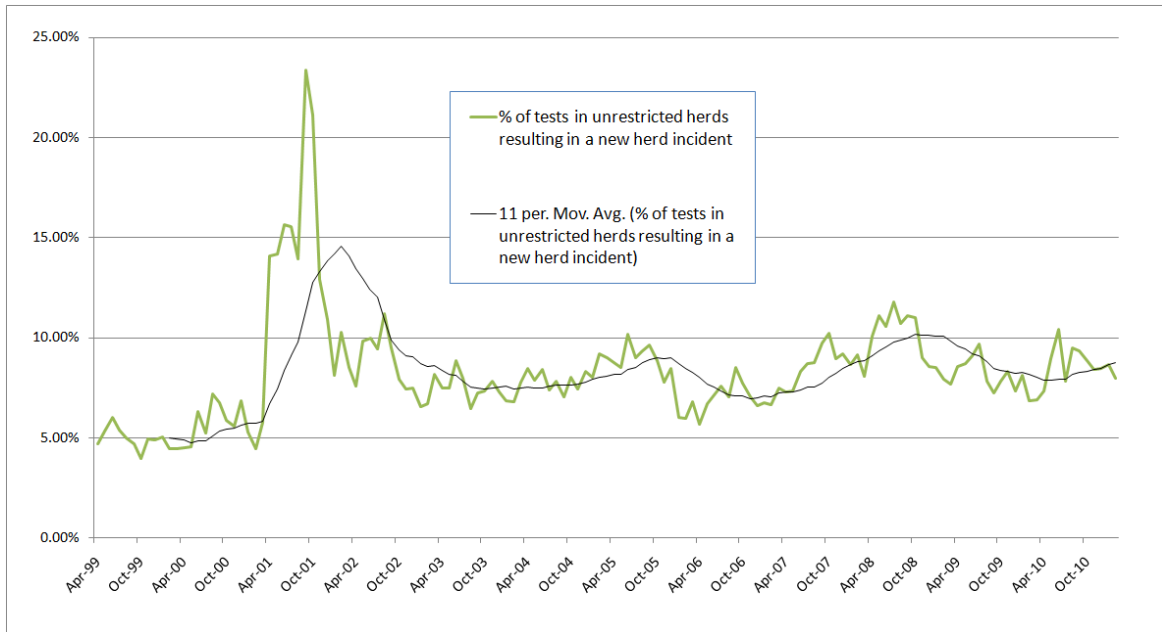


Figure 1: Monthly percentage of tests in unrestricted herds that disclosed a new TB breakdown in England

2.3. The detection of new TB breakdowns in previously unaffected areas of England continued throughout 2010. It is not currently possible to know with any certainty what may have caused the transient reduction in 2009 or increases in 2010. Furthermore one must be cautious about interpreting such transient changes, which may not be related to actual changes in disease incidence but rather be artefacts caused by the testing regime. We will need to await data from future months to see if this upward trend continues, but this suggests that the improvement in the disease situation that we saw during 2009 is not set to continue using our current control measures.

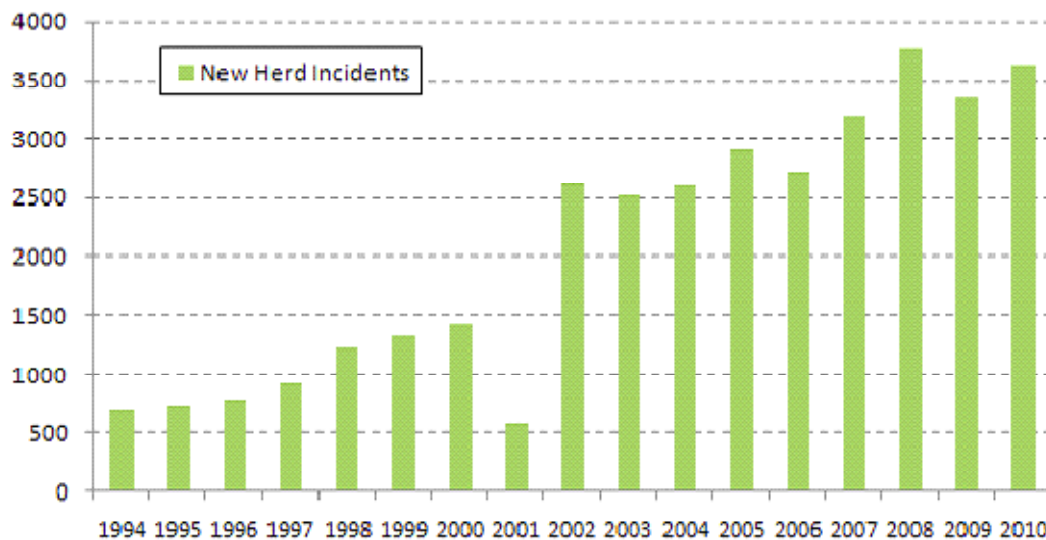


Figure 2: Number of new TB herd breakdowns disclosed annually in England (1994-2010)³

2.4. In the light of this, it is clear that the current control programme has failed to stop the spread of bovine TB to wider geographical areas and to more herds within the infected areas, although over the last 60 years it has been highly successful in eradicating disease and maintaining disease freedom in those parts of Great Britain without a wildlife reservoir (Scotland and North and East England).

2.5. The TB Eradication Programme for England describes the package of measures that we are deploying to tackle TB. We already have a comprehensive range of cattle measures in place to address cattle-to-cattle transmission, including routine testing and surveillance, pre-movement testing, movement restrictions and rapid slaughter of infected animals. These cattle measures will remain the foundation of our TB Eradication Programme and we will continue to look for opportunities to tighten these controls where this would be sensible, proportionate and cost-effective.

2.6. While these approaches may significantly reduce TB levels in some instances, experience from relying on increasing cattle controls alone where there is a reservoir of disease in wildlife suggests that they could only reduce levels of TB, not eradicate it.⁴ Areas of England with a high incidence of bovine TB in cattle also tend to have high

³ The dip in 2001 is due to the suspension of the TB control programme during the Foot and Mouth Disease outbreak.

⁴ Countries and regions outside Great Britain with a wildlife reservoir, i.e. where the wildlife population can sustain bovine TB infection on its own, regardless of bovine TB levels in cattle, include Northern Ireland, the Republic of Ireland, Spain, and New Zealand. These places have not been able to eradicate TB despite long-standing programmes of compulsory, regular testing of cattle herds and slaughter of reactors, although New Zealand has made substantial progress towards eradication of bovine TB by supplementing traditional cattle-based control measures with the systematic culling of infected possum populations. In other countries, including in the USA and Canada, a significant wildlife reservoir became evident when bovine TB was nearing eradication, making it necessary to introduce further control measures in certain regions. Australia achieved bovine TB eradication through stringent cattle controls, combined with a control programme targeting the feral cattle and buffalo reservoir in the Northern Territory. France succeeded in becoming officially TB free in 2000, but localised wildlife reservoirs of the disease have since emerged.

numbers of badgers. The scientific evidence from the Randomised Badger Culling Trial (RBCT)⁵, a £50m Government-funded scientific study carried out between 1998 and 2006, demonstrates conclusively that badgers contribute significantly to bovine TB in cattleⁱⁱ.

2.7. Modelling work using data from the RBCT indicated that, in the absence of transmission from infected badgers, only 3.4% of herds per annum would be expected to have a TB breakdown. This is in contrast to the actual incidence rates of up to 20% seen in high incidence areas. The report of this work concluded that “TB in cattle herds could be substantially reduced, possibly even eliminated, in the absence of transmission from badgers to cattle.”ⁱⁱⁱ

2.8. We have therefore concluded that maintaining the current approach focusing mainly on cattle measures is not sufficient. This approach would incur ever-increasing costs to Government (and therefore the taxpayer), and place increasing costs and burdens on farmers, making it more difficult for farm businesses to remain viable. Even if the disease situation in cattle improves as a result of more intensive TB surveillance efforts, it is unlikely that we will ever be able to eradicate bovine TB from the national herd while an uncontrolled reservoir of infection remains in wildlife. We need to tackle the reservoir of disease in badgers while continuing our efforts to stem cattle-to-cattle transmission.

3. Options considered

3.1. The aim of any badger control policy would be to reduce confirmed cattle herd breakdowns. The control options currently available to us to reduce the transmission of bovine TB from badgers to cattle are biosecurity measures, vaccinating badgers, and/or culling badgers.

Biosecurity

3.2. The maintenance of good biosecurity practices is important in reducing the risk of bovine TB transmission. We are taking forward a number of collaborative initiatives to raise awareness about bovine TB in general and biosecurity, for example:

- the publication, by Defra and AHVLA, of a series of leaflets to assist farmers in preventing, and dealing with, TB in their herds;
- a support and advice service for farmers affected by bovine TB in England, which was launched in November 2010. Through this service farmers can access advice and support to help them minimise TB risks, for example by improving their on-farm biosecurity; and

⁵ Further information on the RBCT is available at:

<http://webarchive.nationalarchives.gov.uk/20081027092120/http://www.defra.gov.uk/animalh/tb/culling/index.htm>

- a recently launched DVD (developed with the NFU and scientific experts) advising cattle farmers on the practical steps they can take to reduce TB risks from wildlife.
- 3.3. Current generic advice on reducing the risk of badger-to-cattle transmission includes keeping badgers away from stored cattle feed, making farmyards less attractive to badgers, and being aware of high-risk areas at pasture. Detailed measures that could be taken need to be considered at the individual farm level, and vary widely in cost and practicality. Defra continues to fund research to identify on-farm risk factors for the presence of badgers.
- 3.4. However, on-farm biosecurity controls are likely only to reduce, not eliminate, TB transmission risks from infectious badgers. Eliminating transmission risks through biosecurity controls can only be achieved in secure cattle containment conditions that are associated with experimental settings – conditions that are very difficult to achieve and impracticable on most working cattle farms. It is possible to protect housed animals but it is much more difficult to stop badger-to-cattle contact at pasture, and therefore there will be a residual risk of disease transmission despite on-farm biosecurity measures being implemented.
- 3.5. While there is evidence that suitably tailored and consistently applied on-farm intervention measures can reliably exclude badgers from some farm buildings, there is no evidence (for example from observational, intervention or cohort studies) on the effect of implementing these on-farm biosecurity changes on cattle TB incidence. Biosecurity measures have an important role to play alongside a badger control policy, but we do not consider that alone they will lead to a substantial reduction in confirmed herd breakdowns.

Badger Vaccination

- 3.6. The aim of badger vaccination is to reduce transmission of TB between badgers and between badgers and cattle, by reducing the severity of disease and the shedding of bacteria from infected individual badgers and reducing the prevalence of disease in badger populations. Laboratory studies have demonstrated that vaccinating badgers by injection with BCG significantly reduces the progression, severity and excretion of TB infection. The findings of the laboratory studies are supported by the results of a four-year safety field-study involving the vaccination of wild badgers. This demonstrated that BCG vaccination of wild badgers in a naturally infected population results in a statistically significant 73.8% reduction in the incidence of positive results to a badger antibody blood test for TB; this is consistent with a protective effect of vaccination as antibody production is positively correlated with the extent and severity of TB infection.
- 3.7. Defra has recently developed an injectable badger TB vaccine (BadgerBCG), which was licensed in March 2010 and has since been available for use on prescription,

subject to a licence from Natural England to trap badgers for injection by vets or trained lay vaccinators. The vaccine is being used in a Defra-funded Badger Vaccine Deployment Project (BVDP) in Gloucestershire, which aims to build confidence in the principle and practicalities of vaccination, develop practical know-how for vaccinating badgers and provide the capacity to train lay badger vaccinators. The project is not a national vaccination programme, nor will it assess the effectiveness of the vaccine in tackling bovine TB. In 2010 more than 500 badgers were vaccinated in the 100km² project area, and more than 600 were vaccinated in 2011. However, outside of this project only very limited vaccination has taken place, most notably by the Gloucestershire Wildlife Trust, by the National Trust in Devon, and a joint project on a few farms by the National Farmers' Union and the Badger Trust.

- 3.8. The ultimate aim of a sustained vaccination campaign would be, over sufficient time, to achieve 'herd immunity' in a badger population – a state in which a large enough proportion of the badgers is protected such that transmission of disease is reduced and disease cannot be sustained. Herd immunity would take time to develop, particularly as the BCG vaccination (as with BCG vaccination in other species) is not 100% effective in preventing TB in badgers; the vaccine will not fully protect or prevent infection in all uninfected badgers that are vaccinated, and there is no scientific evidence that the vaccine will benefit badgers that are already infected. Additionally, not all badgers in an area will be trapped and vaccinated and, depending on the size of the area being vaccinated, badgers from neighbouring unvaccinated areas will act as a constant source of infection.
- 3.9. Benefits from vaccination would therefore be expected to accrue incrementally during a vaccination campaign, as the number of badgers immunised successfully increased and as infected badgers die off naturally. The larger the proportion of infected badgers within the population, the longer it would take to achieve herd immunity.
- 3.10. While we would expect badger vaccination to result in reduced transmission of TB to cattle, we currently have no direct experimental evidence on this. Computer modelling has indicated that sustained badger vaccination campaigns could be beneficial in lowering TB incidence in cattle and that vaccination could be used in combination with culling to increase the benefits in terms of cattle incidence compared to culling alone^{iv}. While such models can contribute to our understanding of the benefits vaccination could provide, the results vary depending on the assumptions used and cannot be considered conclusive and there is no guarantee that these results will be realised. The precise contribution badger vaccination could make to reducing TB incidence in cattle is therefore unknown. To be able to quantify this contribution precisely would require a large-scale field trial (on a comparable scale to the RBCT), and it would be many years before the results of any such trial were available.
- 3.11. One of the main benefits of vaccination is that there is no evidence that it would disrupt badgers' social group organisation and therefore this method of controlling bovine TB in badgers does not have the potential risks arising from perturbation

associated with culling (see paragraph 3.21). Therefore, ineffective delivery of vaccination is unlikely to make the disease situation worse.

3.12. However, the injectable BCG vaccine requires badgers to be trapped before they can be vaccinated by vets or qualified lay vaccinators and is therefore costly (estimated by Defra to be around £2,250/km²/year), drawing on the experience of trapping operations in the RBCT and price quotations received in the competitive tender for the BVDP. While we are starting to see and welcome groups working in partnership with farmers to vaccinate badgers, there still appears to be little interest from most landowners and farmers in paying for badger vaccination themselves, given the costs involved, until they have greater confidence in the ability of vaccination to reduce the incidence of TB in cattle.

3.13. These factors would indicate that for vaccination to be relied on as the main tool to tackle badger-to-cattle transmission, further work is needed to build confidence in the use of vaccination and Government support and encouragement to incentivise or require its use may be needed. However, the costs of widespread badger vaccination would be high and any move to require farmers to undertake injectable vaccination at their own cost is difficult to justify when the effect on cattle TB incidence is unknown.

3.14. Given the current uncertainty about the ability of badger vaccination to reduce TB in cattle, the high cost of deploying it and its estimated effect on the number of TB infected badgers and thus the weight of TB infection in badgers when compared to culling (see paragraph 3.29), we have concluded that vaccination on its own is not a sufficient response to the need to address bovine TB in cattle.

3.15. However, there are ways, in principle, in which badger vaccination and badger culling might usefully be combined, to maximise the benefits of both strategies.

Vaccination could be used:

- to help reduce the potential negative effects of culling due to perturbation over time, for example by using vaccination as a buffer at the edge of control areas, or land within control areas where no culling is taking place, where no other physical buffers or barriers are available. Vaccination itself cannot mitigate badger perturbation (see paragraph 3.21);
- as part of an 'exit strategy' from culling, for example by vaccinating remaining badgers with the aim of establishing herd immunity in previously culled areas; or
- to help reduce spread to new areas by vaccinating at the border of high cattle TB incidence areas.

3.16. We believe that the greatest practical potential for vaccination to support disease control objectives in the short term is to use vaccination in combination with culling, in any gaps within control areas and on land surrounding control areas (where other barriers or buffers to badger movement are not available). To encourage the use of badger vaccination in this way, we will make available up to £250,000 per year in funding in the form of a grant scheme, allowing farmers and landowners to bid for

funding to support planned vaccination activity. Funding will be prioritised where vaccination is proposed for use by non-participants within or adjacent to a control area.

Badger Culling

- 3.17. A proactive, controlled cull of badgers has the potential to reduce bovine TB in cattle by reducing the number of infected badgers, thus reducing the rate of transmission of the disease to cattle. Evidence for the effect of badger culling on bovine TB incidence rates comes principally from the RBCT. The scientific evidence from the RBCT suggests that proactive badger culling, done on a sufficient geographical scale, in a widespread, coordinated and efficient way, and over a sustained period of time of at least four years, will reduce the incidence of bovine TB in cattle in high incidence areas.
- 3.18. The RBCT ran from 1998 to 2007 and was overseen by the Independent Scientific Group on Cattle TB (ISG). The trial took place in thirty 100km² areas of England, which were grouped into ten sets of three areas (“triplets”). In each triplet, one area received repeated culling across all accessible land (proactive culling), one area received culling in response to bovine TB outbreaks in cattle (reactive culling), and the third area received no culling (survey only). Proactive culling operations took place for between four and seven years (averaging 5 years). Reactive culling operations ended in 2003, as early interim results showed an increase of 18.9% in new confirmed TB cattle herd incidents when compared with survey-only areas^v.
- 3.19. The RBCT showed that the effects of proactive culling could be split into two areas: an inner core area where culling took place (“culling area”) and an approximately 2km-wide ring just outside the cull area where no culling took place, but where effects on bovine TB incidence in cattle were seen (“2km ring”). “Survey-only areas” are areas used for comparison, with efforts made to select areas similar in most respects, except for the fact that culling did not take place there.
- 3.20. During the lifetime of the RBCT, annual proactive culling over 4-7 years on accessible land in ten 100km² areas was associated with a 23.2% decrease⁶ in confirmed TB herd incidence inside culling areas when compared with survey-only areas. However, proactive culling was also associated with a 24.5% increase⁷ in confirmed TB herd incidence in the surrounding 2km ring around the culling area when compared with survey-only areas.
- 3.21. The ISG hypothesised that the increase in TB incidence observed in the 2km ring around the culling areas was a result of changes in badger behaviour brought about by culling. Badgers typically live in social groups of 4-7 animals, with defined territorial boundaries. Culling disrupts the organisation of these social groups, which causes surviving badgers to range more widely than they would normally and come into contact

⁶ 95% Confidence Interval (CI): 12.4% decrease to 32.7% decrease. (A 95% confidence interval for a particular figure is the range of values within which one can be 95% confident that the “true” figure lies.)

⁷ 95%CI: 0.6% decrease to 56.0% increase.

more often with other animals (including both cattle and other badgers). This is called perturbation. This increased ranging is hypothesised to be behind an increase in bovine TB in cattle in the 2km ring adjacent to proactively culled areas. Therefore, although total badger numbers were significantly reduced by culling in the trial, the probability of TB being transmitted from the remaining infected badgers to cattle appeared to increase in the short term at the edge of a culled area. This rise in cattle TB incidence at the edge is known as the “perturbation effect”.

3.22. Ongoing monitoring since the end of the RBCT shows that the positive effect of culling on herd breakdowns was maintained for at least six years after culling stopped and that the negative effect on confirmed herd breakdowns on surrounding land disappeared relatively quickly, within 12-18 months after culling stopped.

3.23. Overall, from the first cull to five years after the last cull (i.e. up to July 2010) there was a 28.3% relative reduction⁸ in TB confirmed cattle herd incidence in the 100km² proactively culled areas when compared with survey-only areas. Confirmed TB herd incidence on the land 2km outside the culling area was comparable with that in survey-only areas (9% increase in incidence⁹).¹⁰

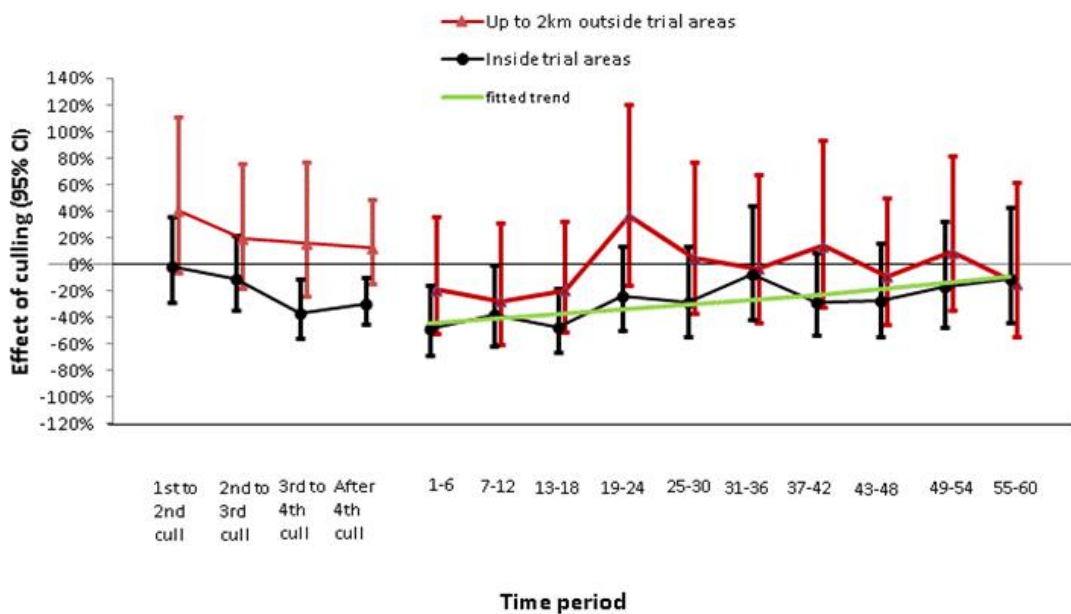


Figure 3: Estimated effects of proactive culling on the incidence of confirmed cattle TB breakdowns inside trial areas and up to 2 km outside trial area boundaries

⁸ 95%CI: 20.9% decrease to 35.0% decrease.

⁹ 95%CI: 15.5% decrease to 40.7% increase.

¹⁰ More recent analyses (up to August 2011) suggest that, from the first cull to six years after the last cull, there was a 25.7% relative reduction (95% CI: 18.7%-32.2% reduction) in confirmed TB cattle herd incidence inside proactively culled areas, while incidence in the surrounding 2km ring was 7.6% higher (95% CI: 14.2% lower to 35.1% higher) than in areas up to 2km outside survey-only areas.

- 3.24. The ISG concluded in its final report in 2007 that, based on the RBCT results at that time and an economic assessment, badger culling, “could make no meaningful contribution to tackling bovine TB in Britain.” The group instead advised that increased cattle controls could achieve substantial reductions in bTB, based on modelling results^{vi}. However, other scientific studies and comparisons with other countries’ attempts to eradicate bovine TB in cattle show that without addressing the reservoir of disease in wildlife or feral animal species, it will not be possible to eradicate the disease in cattle in areas where this reservoir is present, regardless of how stringent a programme of cattle controls are in place^{vii}.
- 3.25. The ISG’s conclusion also reflects the group’s finding that the costs of culling as carried out in the RBCT were significantly greater than the benefits in terms of the number of TB breakdowns prevented, and their view that a farmer-led cull would not meet requirements for coordinated, simultaneous, and sustained action. Ongoing analysis since the end of the trial demonstrates that the benefits of culling in the RBCT persist far beyond the culling period, with the negative effects disappearing within 12-18 months after culling stopped, which improves the economic case. It is a matter of judgement, not science, whether the farming industry can deliver an effective, coordinated and sustained cull.
- 3.26. The consultation stage Impact Assessment¹¹ showed that the cost of a Government-led policy of culling would be high, and too high to justify the benefits achieved in the RBCT. However, there is a stronger economic case for badger control when carried out as a partnership between industry and Government (although depending on the assumptions used, the policy might still result in an overall net cost, see paragraphs 4.12 to 4.21). The case for licensed culling, in terms of the quantified costs and benefits, depends partly on whether culling, by employing a mix of methods (a significant element of controlled shooting where appropriate, with some, cage-trapping and shooting elsewhere) is capable of achieving an impact on the incidence of TB in cattle similar to that seen in the RBCT areas. We consider such a reduction in cattle TB would be significant in tackling the disease at a local level.

Future control tools

- 3.27. We are continuing to invest in other control tools, including cattle and oral badger vaccines to help address badger and cattle transmission; we anticipate investing £20m in TB vaccine research and development over the next five years. However, there are still significant technical, practical and legal issues to overcome before these vaccines will be available; and so it is still likely to be many years before they can be used in the field.
- 3.28. We are currently funding further research with Fera into risk factors for badgers and cattle coming into contact on farms: this could help improve farmer uptake and

¹¹ <http://archive.defra.gov.uk/corporate/consult/tb-control-measures/100915-tb-control-measures-annexf.pdf>

understanding of biosecurity measures. We are also funding further research into non-lethal means of badger control through an immuno-contraceptive product (a birth control method that uses the body's immune response to prevent pregnancy). However, even if this research proves successful, a substantial amount of further work would be needed to evaluate the practicality of this product as a TB control tool.

Conclusion

- 3.29. We have to make a judgement based on the available evidence and, having assessed the known and estimated effects of badger culling and vaccination, Defra veterinary and scientific advice is that culling in high cattle TB incidence areas, carried out in line with strict evidence-based licence criteria (explained in section 5 of this document), will reduce the number of infected badgers and thus the weight of TB infection in badger populations in the treatment area more quickly than vaccination, and therefore have a greater and more immediate beneficial impact on the spread of TB to cattle and the incidence of infection in cattle. When the potential risk of an increase in cattle TB at the edge of the culled area is included, the overall beneficial effect of culling is reduced. However, modelling still suggests that over time culling will outperform vaccination alone and the licence criteria include measures to mitigate against the risk of the perturbation effect on cattle TB at the edge of culled areas.
- 3.30. We recognise that some farmers and landowners may prefer to use vaccination to reduce the prevalence of TB infection in badgers, despite the limitations described above. Licences to vaccinate badgers will therefore continue to be available.
- 3.31. However, for most farmers, badger culling is likely to be the preferred option, leading to a higher uptake. This is an important consideration in the context of a policy which requires the industry to bear the direct costs of badger control. We therefore see a role for both badger culling and badger vaccination as part of a comprehensive and balanced package of measures to tackle TB in cattle.
- 3.32. There are no quick or easy ways of reducing TB transmission between badgers and cattle. The benefits of our interventions will take time to materialise, which makes it important to act now, before the disease situation becomes even worse. Doing nothing is not an acceptable option, and (for the reasons discussed above) we do not consider that either on-farm biosecurity or injectable vaccination of badgers alone are sufficiently satisfactory alternatives to culling.

4. The Impact of Culling

4.1. In deciding whether to proceed with a policy of badger control, we have considered the range of potential impacts.

Impact on the incidence of TB in cattle

4.2. Methods for estimating the effect of culling on the incidence of TB in cattle use the RBCT results. The RBCT results relate to the specific set of circumstances in which the trial was carried out, with results averaged across ten disparate trial areas. As such the results are influenced by numerous variables specific to these areas, which no control area is likely to match exactly.

4.3. However, by extrapolating these results, it is possible to estimate the average net effect of proactive badger culling carried out in the same way as the RBCT on confirmed cattle TB herd breakdowns for a range of scenarios (for example by varying the size of the control area, cattle herd density and annual herd incidence in both the culling area and adjacent 2km ring). The overall size of the effect depends on the balance between the effects in the culled area and those in the adjacent 2km ring.

4.4. Extrapolating the RBCT results to a circular 150km² area and 2km adjacent ring (which has a total area of 99km²)¹², we would expect to see an average net benefit of a 16% reduction¹³ in the number of new confirmed cattle herd TB incidents across the culled area and adjacent ring over a nine year period (5 years culling and 4 year post-cull period), relative to an epidemiologically similar uncultured area. An average of 16% reduction equates to preventing 47 out of 292 breakdowns over nine years, over the 150km² culled area and 2km surrounding ring.

4.5. The estimated 16% reduction in cattle TB is against a background of cattle control measures as carried out at the time of the RBCT, and the figure is calculated using a series of assumptions, which would be different in each culling area (a range of possible scenarios is considered in Table 1 below). Any additional controls applied to the culled area as part of a balanced package of measures (for example enhanced biosecurity) could change the overall size of the reduction in cattle TB incidence.

4.6. What would be seen in reality would depend on a range of factors that have an influence on how effective the culling strategy is, and how well any perturbation effect is controlled. The RBCT provides evidence on what factors must be taken into account in understanding how to maximise the likelihood of a proactive culling strategy having a beneficial effect. These factors include:

¹² Using the figures from the RBCT post-trial analyses up to 2 July 2010 and assuming an initial cattle TB incidence of 0.15 confirmed new incidents (CNIs) per km² within the 150km² area and 0.10 CNIs per km² in the adjacent ring, which is consistent with the Veterinary Laboratory Agency's recent estimates of incidence in the worst affected TB areas.

¹³ 95%CI: 7.9% decrease to 24.2% decrease.

Department for Environment, Food and Rural Affairs

- cattle herd size;
- current TB herd incidence in the culled and peripheral areas;
- density of badgers;
- prevalence of TB in badgers;
- culling efficacy (the numbers of badgers caught over a given time period);
- land access;
- coordination of the culling effort; and
- barriers to badger movement and/or increased transmission of infection (for example by vaccination).

Size of area	TB Confirmed New Incidents (CNIs) in the culled area per km per year		
	<i>TB CNIs in 2km ring per km per year</i>		
	0.10/0.10*	0.15/0.10**	0.085/0.046[†]
150 km ² (surrounding area is 99 km ²)	-12.4% (-21.8% to -3.1%)	-16.0% (-24.2% to -7.9%)	-17.7% (-25.4% to -10.0%)
350 km ² (surrounding area is 145.2 km ²)	-16.6% (-24.5% to -8.6%)	-19.6% (-26.9% to -12.3%)	-20.9% (-28.0% to -13.8%)

Table 1: The estimated average net effect of proactive badger culling on the incidence of confirmed cattle TB breakdowns culling over a range of scenarios (5 years culling, 4 years post-cull). Figures in italics correspond to the 2km ring. Figures in brackets indicate the 95% confidence interval associated with each estimate.

* As used in the example reported in Jenkins *et al.* (2010)

** VLA most recent estimates of incidence in the worst affected areas in England

[†] Average initial incidence observed in the RBCT

4.7. The aim of culling is to deliver a reduction in confirmed new incidents of TB in cattle within culled areas, comparable to the average benefit seen in proactively culled areas of the RBCT.¹⁴ In order to offset the risk of an increase in confirmed new herd incidents of TB in cattle on land in the 2km ring surrounding the culled area, the policy (as set out in section 5 of this document) has been designed to provide confidence that there will be a net overall benefit in terms of confirmed new herd incidents of TB in cattle in the culled area and the 2km ring combined.¹⁵

¹⁴ In proactively culled areas of the RBCT, from the first cull to 5 years after the last cull (i.e. up to July 2010) there was a 28.3% reduction (95% confidence interval: 20.9% decrease to 35.0% decrease) in TB confirmed cattle herd incidence in culling areas when compared with survey-only areas.

¹⁵ The minimum size of the culled area has been set to give 97.5% confidence of an overall beneficial effect over the culled area and surrounding 2km of land, based on calculations from the effect sizes seen in the RBCT from the first cull until 3.5 years (42 months) after the last cull (Jenkins *et al.*, 2010). Other licence criteria (such as minimum land access levels) have been set to be at least as stringent as those adopted in the RBCT, if not more so where RBCT averages have been set as minimum criteria in this policy.

4.8. For culling to be effective in achieving this aim, the scientific evidence from the RBCT suggests culling needs to be carried out on a sufficient geographical scale, in a widespread, coordinated and simultaneous way, and over a sustained period of time of at least four years (as explained below).

Impact on the badger population

4.9. Badgers are not an endangered species in the UK, but they are protected by UK legislation. The Protection of Badgers Act 1992 (PoBA) and the Wildlife and Countryside Act 1981 (WCA) protect badgers and their setts, but make provision for licences to be granted to kill or trap badgers (using a specified method) or to interfere with their setts for the purpose of preventing the spread of disease, provided the methods of capture and dispatch are humane.

4.10. To achieve the anticipated net benefits we estimate that between 1000-1500 badgers would be culled over a 150km² area over four years. Whilst in theory any culling strategy would be selective (i.e. only infected badgers, or badgers in a sett in which TB has been detected, would be culled), there is no adequately sensitive or reliable field-based test available to enable detection and selective culling of individual infected badgers, or badgers from infected social groups.

4.11. We are not attempting to eradicate the disease in cattle nationally by culling badgers (and culling would not take place over the whole of the endemic area at the same time) but rather to make an effective contribution to the eradication programme, which comprises a package of different measures (including cattle measures as described in paragraph 2.5 and biosecurity measures), and there would be no culling over the whole endemic area at the same time. To limit the impact of the policy on badger populations, measures will be in place to ensure that some badgers remain in each control area and that culling is not detrimental to the survival of the badger population concerned (see paragraphs 5.52 - 5.55 below).

Economic impacts

4.12. A full Impact Assessment has been prepared for this policy and is available on Defra's website.^{viii} This illustrates a scenario based on culling in an illustrative 350km² circular area.¹⁶

¹⁶ These figures are based on an illustrative circular area, in which badgers are culled in 70% of a 350km² area, chosen to have half of its boundary as a geographic buffer (for example the coast), 40% of the boundary unprotected (and therefore vulnerable to perturbation effects) and 10% of the boundary protected by vaccination. The proposed policy is not prescriptive about the combination of culling, vaccination or use of geographical barriers/buffers, so this scenario is one possibility used for illustration in the Impact Assessment.

Department for Environment, Food and Rural Affairs

- 4.13. The Impact Assessment illustrates that culling would result in a net cost to farmers of £0.265m. The cost to farmers of coordination, culling and measures to reduce the impact on non-participants over 10 years is estimated at £1.40m, with savings of £1.13m from avoiding cattle TB breakdowns over 10 years.
- 4.14. Since Government bears much of the cost of dealing with TB breakdowns, most of the benefits of this policy accrue to the taxpayer. The costs to Government are those for the licensing operation (undertaken by Natural England) and to monitor the impacts of the policy; and the cost of any initial increase in TB incidence as a result of a perturbation effect.
- 4.15. In addition to the costs of licensing and monitoring each culling operation, the Government will also incur policing costs (depending on the extent of any illegal protest activity). The nature and scale of the policing response will depend on specific intelligence available at the time. However, an estimate of police costs has been developed through discussion with the Association of Chief Police Officers (ACPO) and the Home Office. This initial estimate suggests a cost in the region of £0.5m/area/year for the four years when culling would take place in the pilot areas (i.e. £2m per area) based on a standard policing operation to maintain public order and safety.
- 4.16. The Impact Assessment suggests that the central estimate of the net financial impact of the policy in an illustrative 350km² area is -£0.88m – a net cost overall, with a net cost of £0.59m to Government. However, depending on the assumptions made about the costs and benefits of the policy (e.g. the savings achieved from having fewer cattle herd breakdowns, the cost of farmer-delivered culling, and the cost of policing), culling in one 350km² area could lead to a net benefit of £1.59m.
- 4.17. The cost assumptions used in the Impact Assessment are for the pilot areas, and it is likely that the Government costs would be lower for areas licensed subsequently as the monitoring costs in particular would be lower. The farming industry is also confident that it can deliver culling at a lower cost than estimated in the Impact Assessment. There are however plainly some uncertainties around the estimated costs and benefits. This provides an additional reason for the decision to proceed cautiously with a pilot in two areas initially before considering whether to proceed with a wider roll-out. (That cautious approach is in any event justified by the desirability of conducting a pilot to test our expectations in relation to the efficacy, safety and humaneness of culling by means of controlled shooting.)
- 4.18. Culling in two pilot areas will enable us to test our and the farming industry's cost assumptions for elements of the policy where there is currently uncertainty. Alongside the outcome of the evaluation of culling in the pilot areas (see paragraph 6.1), this will also inform our decision on wider roll-out of the policy.
- 4.19. Even if the experience of culling in the pilot areas provided evidence that culling could only be carried out at a net cost to Government and the farming industry, this

would not necessarily undermine the case for wider roll-out for the purposes of preventing the future spread of disease (and the associated escalating costs to farmers and taxpayers), or for the contribution that effective badger control can make as part of a wider package of measures to tackle TB in cattle. This wider package of measures, set out in the TB Eradication Programme for England aims to stop the disease spreading in the short-term, bring it under control, and ultimately eradicate it. In dealing with a problem such as bovine TB, the costs and benefits of the package as a whole must be considered – the economic justification for wider roll-out of a badger control policy must therefore be considered in this wider context.

- 4.20. It is also important to note that the Impact Assessment does not take into account the non-monetary benefits of the policy such as the stress and ill-health that bovine TB can cause among farmers – something that is difficult to quantify, but nonetheless is an important consideration¹⁷.
- 4.21. Critically, the success of this policy depends on a commitment and willingness from industry to accept the costs of culling for the non-financial benefits of freedom from TB in cattle. The industry is committed to doing this and believes that it can achieve better results than those seen in the RBCT.

Ecological impacts

- 4.22. Culling and/or vaccinating badgers could have a range of potential impacts on the ecosystem. We cannot identify the exact ecological impacts as they would be specific to the locations of licence areas and these would not be known until licence applications were made. The potential impacts can be summarised as direct physical impacts on habitats or species caused by activities such as driving vehicles, clearing vegetation, use of lights, use of guns, and repeated and increased access to the same area of land. Direct impacts could result in disturbance, direct damage or harm to protected species and habitats, and the accidental capture of non-target species. Indirect impacts (such as possible increases in fox or hedgehog numbers) would be caused by the reduction in badger density and changes in predation and competition. While it cannot be conclusively ruled out that there will be any significant ecological impacts (as we cannot determine exact sites where badger control will take place until applications for licences are made) we believe the effects will be minimal.
- 4.23. A licence application might be received for an area that includes a European Site, or is close enough to a site that impacts on its habitats or species are possible. For example, in the case of a European Site designated for its ground-nesting bird population, the potential negative effects of increased fox numbers and any potential nest predation. As part of the licensing process Natural England will undertake a

¹⁷ The Farm Crisis Network published a report in 2009 called 'Stress and Loss: a report on the impact of bovine TB on farming families' which provides some evidence on the emotional impact of bovine TB on farmers and their families. The report is available at: <http://www.farmcrisisnetwork.co.uk/latestnews/stress-and-loss-a-report-on-the-impact-of-bovine-tb-on-farming-families>

screening exercise to determine whether the application may have a significant effect on a protected European site. Unless such an effect can be ruled out they will carry out an appropriate assessment of each application. A licensed area may also have implications on a bird species protected under the Wildlife and Countryside Act 1981 caused for instance by shooting or by digging traps. The licence application would have to show that no planned actions would contravene applicable legislation.

Impact on public safety and security

- 4.24. Responses to the 2010 and 2011 consultations raised concerns about the impact of culling operations on public safety and security, both from the use of controlled shooting and the potential disruption of culling activities by those opposed to badger culling.
- 4.25. We are confident that culling can be delivered safely through controlled shooting, given the widespread use of this method in the control of other species. As described below, all those carrying out controlled shooting or cage-trapping and shooting would be required to attend relevant training, demonstrate competence, and adhere to Best Practice Guidance to ensure that the highest standards of safety are maintained. Natural England will also seek advice from local police forces on whether additional licence conditions are required to protect public and operator safety (for example, not permitting controlled shooting close to villages or towns, and setting certain conditions when shooting near public rights of way).
- 4.26. While we recognise the right of those opposed to badger culling to undertake peaceful protest, those operators undertaking culling activities under licence have the right to do so without fear or intimidation. The police have been closely involved in the development of the policy and will liaise with the industry to discuss appropriate security arrangements and will monitor the situation on the ground to ensure public safety.

Is culling a proportionate response?

- 4.27. As discussed above, we would expect to see an average 16% reduction¹⁸ in the number of new confirmed cattle incidents in a 150km² control area and the 2km neighbouring ring, over a nine-year period (including 5 years of culling, 4 years post-cull), relative to an epidemiologically similar uncultured area. An average 16% reduction equates to preventing 47 out of 292 breakdowns over nine years, over the control area and surrounding ring. An estimated 1000-1500 badgers would be culled in each 150km² culled area over the four years to achieve this benefit (based on data from the RBCT). Larger areas would result in a greater number of badgers being culled and a greater net benefit – preventing a larger number of herd breakdowns.
- 4.28. The 2010 public consultation on the proposed badger control policy highlighted the concern of a large number of respondents about the impact on the badger

¹⁸ CI 7.9%-24.2%

population. As noted above, badgers are a protected species, but they are not endangered in England. The PoBA allows the 'killing or taking' of badgers under licence for the purpose of preventing the spread of disease (section 10(2)(a)).

4.29. Independent epidemiological advice^{ix} on whether the levels of reduction of TB in cattle achieved in the RBCT could be considered substantial in terms of disease control concluded that indications of reductions in new confirmed herd breakdowns of 28% inside the area, and 12.4% when looking at the net effect both inside and outside the culling area, are in themselves substantial reductions in the incidence of TB in cattle. Furthermore because the bovine TB is essentially a chronic and "slow-moving" disease, reductions of this magnitude might be expected to have a more significant and longer-term impact than they would on a more rapidly spreading disease.

4.30. **We are satisfied that culling badgers in line with the strict licence criteria outlined in section 5 below will prevent the spread of TB in the culled area and we consider a reduction of the scale seen in the RBCT to be substantial in the context of dealing with bovine TB, which is a "slow-moving", chronic, latent and infectious disease.**

4.31. We would not want to see culling continue for any longer than is necessary, but there are no easy solutions to the problem. We have come to the conclusion that the importance of achieving the anticipated net reduction in bovine TB in cattle at a local level from culling in areas where the disease is endemic (in control areas of the size envisaged and for the period for which that benefit is anticipated), and the benefit of allowing farmers to manage the risks to their herds, are sufficient to justify the number of badgers that would be killed.

4.32. **Our policy is therefore to license groups of farmers/landowners to cull badgers for the purpose of preventing the spread of bovine tuberculosis (TB) in cattle (subject to a set of strict policy requirements as set out below).** Licences to vaccinate badgers will continue to be available for farmers/landowners who wish to use vaccination either alone, or in combination with culling.

5. The Policy

5.1. The scientific evidence for this policy shows clearly that in order to achieve a net reduction in the number of new confirmed TB herd incidents, culling must be done on a sufficient scale, in a widespread, coordinated and efficiently way, and over a sustained period of at least four years.

5.2. The Government's policy is to enable farmers and landowners to cull and/or vaccinate badgers under licences granted under the Protection of Badgers Act 1992 and Wildlife and Countryside Act 1981. Defra's "Guidance to Natural England on the implementation and enforcement of a badger control policy" (issued under section 15(2)

of the Natural Environment and Rural Communities Act 2006 (“the NERC Act”) sets out what is required, on the basis of current scientific evidence, in order for any cull of badgers to be effective, safe and humane.

5.3. Applications will need to meet the criteria contained in this guidance in order to be granted a licence. We expect groups of farmers/landowners who, collectively, meet these criteria to submit one co-ordinated application. Natural England will require applicants to submit a Badger Control Management Plan to demonstrate how they meet the policy and licensing requirements.

5.4. Initially in the first year, culling will be piloted in two areas, to test our assumptions about the effectiveness, humaneness and safety of controlled shooting, overseen by an independent panel of experts. If monitoring of the humaneness, effectiveness and safety indicates that controlled shooting is an acceptable culling technique, then and only then would this policy be rolled out more widely.

Licence conditions for culling

5.5. The conditions which must be met in order for a licence to be granted are as follows.

All participating farmers are complying, and for the duration of any licence will continue to comply, with current statutory TB controls.

5.6. In order to maximise the benefits of badger control, it is essential that all participating farmers comply with statutory TB controls. As discussed above, cattle controls are effective in reducing the transmission of disease and the badger control policy is intended to supplement this. The benefits of badger control will not be realised unless there is also compliance with the existing measures. A farmer will be considered non-compliant if AHVLA is taking enforcement action because of an overdue TB test.

Reasonable biosecurity measures must be, and for the duration of any licence must continue to be, implemented by participants on their land. For this purpose “reasonable measures” means measures that in the particular circumstances are practicable, proportionate and appropriate.

5.7. As noted in paragraph 3.2, maintaining good biosecurity practices is important in reducing the transmission of bovine TB. Culling is part of a package of measures outlined in the TB Eradication Programme for England; and to maximise the benefits of culling, participating farmers must demonstrate good biosecurity. Maintenance of good biosecurity practices on non-participating farms in the 2km surrounding ring could also reduce the risks associated with perturbation.

5.8. We recognise that the measures that might be appropriate to a specific farm vary widely from farm to farm, both in terms of cost and practicality. Therefore, there is not a generic list of measures to be implemented by all participating farms, but Natural

England will need to be satisfied that reasonable measures are in place on all participating farms within the control area before a licence is granted.

The application must cover an area of at least 150km².

5.9. Assuming that the effects of culling are consistent throughout affected areas, Jenkins et al. (2010) showed that, to be 97.5% confident that culling will have a net beneficial effect (over the culled area and adjacent 2km surrounding ring), it must be carried out over an area of at least 141km². This figure is based on data collected from the RBCT areas over the period up to three and a half years after culling stopped. There is no empirical evidence from an experimental study covering an area of this size. We have rounded this figure up to 150km² as the minimum size of area acceptable for culling.

5.10. We do not consider it necessary to place a maximum limit on the size of the control area. There is no scientific evidence on the appropriate upper limit of a control area. We consider that the size of individual control areas will be limited both by the need to conduct culling simultaneously over the whole control area over a six week period, and by the need to design a control area with appropriate barriers and buffers (see paragraphs 5.18 to 5.21). It is important that applicants have the flexibility to match the control area to the available natural barriers and buffers and we do not wish to restrict this by placing a maximum size on the area.

The culling area must be composed wholly of land in an annual routine TB testing area (i.e. an area within which cattle herds are subject to annual testing for TB).

5.11. Under EU Directive 64/432/EEC, routine TB herd testing intervals are calculated according to the annual percentages of cattle herds confirmed as infected with TB in a defined area, calculated over a period of two to six consecutive years. As a result, herds situated in areas with a higher rate of TB breakdowns are tested more frequently. Routine herd testing intervals, ranging in England from one to four years, are set AHVLA based on the historic TB incidence in the area and other epidemiological considerations. More than 90% of new TB breakdowns each year occur in the core area of endemic bovine TB incidence in the West of England and the West Midlands, where herds undergo annual TB testing. This is also the area where badgers are usually implicated in the spread of disease¹⁹.

5.12. There are three reasons for requiring that the control area must be wholly under an annual routine TB testing frequency:

- to ensure that culling is confined to endemic TB areas, where it is clear that there is a genuine disease problem to resolve for which a licence under s.10(2)(a) of PoBA is appropriate;

¹⁹ See: <http://animalhealth.defra.gov.uk/managing-disease/notifiable-disease/bovine-tb/parish-testing-intervals.html>

Department for Environment, Food and Rural Affairs

- to ensure that culling achieves at least the benefits observed in the RBCT, where culling was targeted at endemic areas with a high historical and starting incidence of bovine TB in cattle; and
- to ensure that the control area is in a region where there is a recognised established reservoir of TB infection in badgers (and therefore that culling will contribute to a reduction in disease).

5.13. A “recognised established reservoir” of TB in badgers can be considered to be present where:

- TB incidence in cattle is high compared to the rest of England;
- there is evidence for TB in badgers (and there is evidence that culling badgers in some of these areas leads to a decrease in cattle TB); and
- TB incidence in these areas is not improving despite cattle control measures.

5.14. For reasons relating to the availability and accuracy of data, the presence of a badger reservoir should be viewed at a regional, not local scale. Various estimates have been made of average disease prevalence in badgers in areas where TB is endemic, ranging from 11.3% (from the initial proactive culls in the RBCT) to over 70% (from previous badger removal operations), though this will vary from no badgers to all badgers within a social group being infected. All previous surveys have underestimated prevalence because they have used a standard rather than detailed post-mortem examination, the latter being found to double previous prevalence estimates^x. Such prevalence estimates are considered high for a chronic disease such as tuberculosis which is slow-moving through a population and not highly contagious.

5.15. Areas of England (South-West and Midlands) that have a high incidence of TB in cattle tend to also have a high number of badgers and TB is considered to be endemic here with clustering of the same strains of *M. bovis* being found in both species. Various groups have estimated the proportion of cattle TB breakdowns that are due to badgers. Using the evidence from the RBCT, the most recent estimate is approximately 50%^{xi}.

There must be access for culling over at least 70% of the total land area.

5.16. In the RBCT, there was access for culling to on average 70% of the total land area in the control areas. To achieve at least the same net benefits of culling as seen in the RBCT we are setting the minimum land access at 70% of the area subject to a licence application.

The size and number of inaccessible areas of land within the application area should be minimised, with at least 90% of land within the application area either accessible or within 200m of accessible land.

5.17. Post-RBCT analysis found that approximately 90% of the whole area was either accessible or within 200m of accessible land and was therefore 'effectively culled' by trapping on land adjacent to inaccessible land.^{xii} This was supported by results showing increased trapping success around the periphery of inaccessible areas, indicating that it was picking up animals from the un-trapped land. In addition, a beneficial effect, in terms of reduced herd breakdown incidence, was recorded on uncultured land within 0.5km of the boundary of proactive cull areas in the RBCT, suggesting that culling in the proactive areas had an impact on badger populations on this land.

Applicants must have put in place reasonable measures to mitigate the risk to non-participating farmers and landowners of a potential increase in confirmed new incidents of TB in vulnerable livestock within the control areas and in the 2km ring surrounding the control area; and to protect the interests of any non-farming interests that may be affected by badger control.

For this purpose "reasonable measures" means measures that in the particular circumstances are practicable, proportionate and appropriate. When assessing the reasonableness of measures, applicants and NE should take into account the cost of measures relative to the proportion of the potential additional cost to non-participants (arising from the anticipated increase in TB incidence) that could be avoided by taking the measures.

5.18. As explained in paragraph 3.17 above, the initial increase in TB incidence in cattle in the surrounding 2km ring is believed to be due to perturbation. While barriers and buffers were used 'where possible' in the RBCT, the boundaries of the RBCT areas mainly followed property boundaries and were therefore easily traversed by migrating badgers.

5.19. The licensing criteria are designed to deliver an overall net benefit in terms of TB in cattle, taking into account any negative effects, without the need for additional measures, such as in the installation of badger-proof fencing, vaccination of badgers or enhanced biosecurity controls in the 2km ring. However, we can assume that greater net benefits from proactive culling could be expected if additional measures were taken beyond those taken in the RBCT to minimise the detrimental effects at the edges of the culled area. Likewise, greater net benefits from proactive culling could be expected if additional measures or safeguards were in place to minimise the potential detrimental effects on inaccessible and non-participating land within the culled area, such as barriers or buffers.

5.20. Therefore, applicants will be required to have in place reasonable measures or safeguards to mitigate the risk to non-participating farmers and landowners of a potential increase in confirmed new incidents of TB in vulnerable livestock within the control areas and in the 2km ring surrounding the control area. These reasonable measures or safeguards might comprise geographical / natural barriers or buffers (such as a sea coast, lakes and reservoirs or motorways) or measures such as badger-proof

Department for Environment, Food and Rural Affairs

fencing, badger vaccination or enhanced biosecurity controls. If non-participating farmers do experience TB breakdowns they will continue to receive Government compensation for their animals.

- 5.21. To ensure that people in the locality who may potentially be affected by the proposed culling operation have an opportunity to express their views, Natural England will provide an opportunity to submit information that may be relevant to the determination of the licence.

Applicants must enter into an agreement with Natural England under section 13 of the NERC Act (the “Badger Control Agreement”) requiring them to comply with the requirements contained in this guidance and any additional licence conditions for the purpose of ensuring that –

- an effective cull is carried out each year for a minimum of four years; and
- the financial deposit (see paragraph 9j) is sufficient and is managed appropriately.

- 5.22. Government must have confidence that each culling operation, once started, will be completed effectively to ensure the anticipated benefits will be realised (and to avoid the risks of a detrimental impact on the incidence of bovine TB associated with ineffective culling). We have therefore developed a robust enforcement model.

- 5.23. The licensee and all participating farmers will be required to enter into agreements under the NERC Act, which will set out their obligations once a licence is granted and, if necessary and as a last resort, allow Government to intervene, access all participating land, take over responsibility for a culling operation, and recover the costs from the licensee and/or participants (should the participants fail to meet the conditions of the licence).

- 5.24. The licensee will be required to sign an agreement under section 13 of the NERC Act. This will require the licensee to comply with the conditions of the licence, ensure that the up-front financial deposit is managed appropriately and ensure that participating farmers take appropriate biosecurity measures.

- 5.25. Natural England will apply its published Enforcement Policy Statement to breaches of licences that it has issued. (Alleged offences that are not breaches of licences must be reported to the police for investigation). If it becomes necessary to revoke a licence because of a breach in compliance with licence obligations, Government will intervene to complete the cull to ensure that it is delivered effectively for the remaining term of the licence. The cost of completing this cull will be recovered from the participants (who will agree to meet such costs through the section 13 and section 7 agreements).

All participating farmers must enter into agreements under section 7 of the NERC Act requiring them to permit access to their land for culling (including by Government) and to take appropriate biosecurity measures (as required in paragraph 9b).

Where land is tenanted, the freeholder owners (or landlords) must generally also sign an undertaking appended to this agreement agreeing to permit access to the land for culling (including by Government). Natural England may permit dispensations in certain cases, provided it considers that the likelihood of the total accessible land falling below 70% as a result of the termination of any tenancy (for any reason) remains very low. Any such consideration is expected to take into account:

- i. the margin of accessible land above the minimum of 70%;
- ii. the proportion of accessible land where the freehold owner is not participating; and
- iii. the length of the tenancies to which the accessible land is subject.

5.26. All participating farmers will be required to sign a separate agreement made under section 7 of the NERC Act, permitting access to land for culling, agreeing that the licensee of Government can recover any additional costs of culling and agreeing to comply with appropriate biosecurity measures.

5.27. In order for the Secretary of State to be confident that a culling operation can be completed effectively, it is necessary to ensure that there will continue to be access to at least 70% of the land for the duration of the licence. Therefore, where land is tenanted, it will also normally be necessary for the freehold owner (or landlord) of that land to sign a declaration to the agreement to ensure that access continues to be available if the original tenancy were to end.

Applicants must have arrangements in place to deposit sufficient funds in a reputable bank to cover the total cost of a four-year cull, plus a contingency sum of 25%. (The level of the contingency sum will be reviewed after the first year of culling in the two pilot areas). This deposit must be made before culling begins into an account held by the applicants. Applicants will need to provide evidence to support the cost estimates and confirmation from the bank that the deposit has been made.

The funds must be managed in line with the requirements set out in the Badger Control Agreement, including the requirement to ensure that at all times the amount remaining in the account is sufficient to ensure that culling is carried out in accordance with the licence and the Badger Control Agreement.

5.28. Participants will also be required to deposit sufficient funds to cover the total expected cost of the four-year cull (plus a contingency sum) before culling begins. This deposit must be sufficient to cover the cost as estimated by the participants on their basis of their agreement with their contractors. Government would be able to recover its costs in the event that it needed to intervene and assume responsibility for that culling operation. The purpose of requiring these funds up-front is to provide the

Department for Environment, Food and Rural Affairs

Secretary of State with confidence that the participants have access to the resources necessary to complete the cull effectively.

Applicants must satisfy Natural England that they are able to deliver an effective cull in line with the policy and have arrangements in place to achieve this. To deliver an effective cull, the following requirements [(a) and (b) and (c) below] must be met:

- a) culling must be coordinated on accessible land across the entire control area;
- b) culling must be sustained, which means it must be carried out annually (but not in the closed seasons) for the duration of the licence (minimum of four years).
- c) The killing/taking of badgers must be limited to a six-week cull period specified in each licence. Culling will not be permitted during the following closed seasons:
 - i. 1 December to 31 May for cage-trapping and shooting;
 - ii. 1 February to 31 May for controlled shooting; and
 - iii. 1 December to 30 April for cage-trapping and vaccination.

5.29. Culling will need to be sustained annually for the period stated in the licence. This will be for a minimum of four years, because in the RBCT culling did not give a statistically significant overall benefit until the fourth annual cull had taken place. The beneficial effect on cattle TB inside trial areas appeared to increase with successive badger removals. Evidence from computer modelling^{xiii} also shows that stopping culling early is more likely to lead to an overall increase in cattle herd breakdowns across the culled area and adjacent 2km ring.

5.30. Culling would also need to be carried out simultaneously across the entire area, so that culling takes place on all participating land within a maximum period of six weeks.

5.31. In the RBCT, of 51 proactive culls, 47 were carried out as an intensive single removal effort across 100km², over 8-11 (mostly) consecutive nights with no follow-up culling during the same year. On the four occasions where proactive culling was conducted in a sequential manner, sector by sector, over a period of several months, rather than in a single operation, it was associated with a greater rise in TB prevalence in badgers.

5.32. This data was carefully considered by a joint group of members from Defra's Science Advisory Council and TB Science Advisory Group agreed that the four occasions when proactive culling was carried out sector by sector were not definitive evidence that non-simultaneous culling would not be effective under any circumstances. The Group advised that if culling was carried out in a period of up to six weeks (although preferably less), i.e. not "in a piecemeal manner over a period of several months", that was likely to reduce the adverse effects of non-simultaneous culling; although it did emphasise that this advice is based on opinion and not on evidence.

The longer taken to achieve a substantial reduction in the badger population (to the 70% target reduction), the weaker the grounds for confidence that the detrimental effects seen with non-simultaneous culling as carried out in the RBCT will be minimised. Six weeks has been chosen as an appropriate period that balances the evidence from the RBCT and the Group's advice, with the need to develop a policy that is deliverable across areas of at least 150km².

5.33. Cage-trapping and shooting, controlled shooting and vaccination require adherence to a closed season to avoid cruel ill treatment to the animal or to any dependent off-spring. The duration and timing of the closed season balances badgers' welfare requirements against disease control requirements. A closed season limits the effectiveness of disease control, as it limits the time available for control (and therefore the number of badgers removed), but is desirable for welfare purposes to prevent cruel ill treatment.

5.34. In the winter, the closed season aims to protect trapped badgers from poor weather conditions. In the spring, it aims to minimise the risk of removing lactating sows and so leaving dependent cubs underground. The timing of these seasons has been set using evidence from culling during the RBCT and expert ecological advice.

c) Culling must remove a minimum number of badgers each year as specified below:

i. in the first year of culling, a minimum number of badgers must be removed through an intensive cull which must be carried out throughout the land to which there is access, over a period of not more than six consecutive weeks. This minimum number should be set at a level that in Natural England's judgement should reduce the estimated badger population of the application area by at least 70%;

ii. a minimum number of badgers must also be removed in subsequent years of culling through an intensive cull which must be carried out throughout the land to which there is access. This minimum number should be set at a level that in Natural England's judgement should maintain the badger population at the reduced level achieved through culling in the first year.

5.35. The agreement with the licensee will also include a requirement that at least 70% of the estimated badger population within the cull area is to be removed in the first year, and over the four-year period of culling taken as a whole. The proportion of the badger population removed in each of the proactive removal trial areas during the RBCT was estimated to be around 70% on average (range 32-77%)^{xiv}. To provide confidence that at least the same benefits as seen in the RBCT will be achieved, 70% of the badgers must be removed.

5.36. For disease control purposes, as many badgers as possible should be removed, but this needs to be balanced with the requirement under the Bern Convention to prevent local disappearance of badger populations, and consequently a maximum

number of badgers which can be taken will also be specified in the licence (see paragraph 5.52 below).

5.37. Estimating badger populations accurately is difficult. However, we have a large amount of information from past fieldwork (including the RBCT, the Badger Vaccine Study, studies at Woodchester Park, and previous national badger and road traffic accident surveys) that can be used to estimate badger numbers. In addition, we have commissioned a national badger survey to update these estimates and a desk-based study which uses existing data to make better estimates of the number of animals per social group.

5.38. Natural England will use this available information in combination with applicants' own assessment of the numbers of setts present on their land to estimate the size of the badger population within a licence area and advise applicants on the minimum number of animals they need to remove to reduce the estimated badger population in the area by at least 70%. All badger carcasses would be recorded (as they have to be disposed of as Category 1 waste under the Animal By-products Regulations) and this information, along with information provided by the licence coordinator, will be used by Natural England to calculate the proportion of badgers that had been culled.

Applicants must satisfy Natural England that they are able to deliver the cull as safely and humanely as possible. The following requirements [(a)-(c) and (d) below] must be met in that respect:

- a) in order to ensure humaneness, only two culling methods will be permitted (which can be used in combination, or as single control methods):
 - i. cage-trapping followed by shooting; and
 - ii. controlled shooting.
- b) those licensed to kill badgers must be able to demonstrate a level of competence appropriate to the method they will be licensed to use. Successful completion of a training course approved by Government will be taken as proof of competence.
- c) culling must be in line with the Best Practice Guidance.

5.39. Cage-trapping and shooting and controlled shooting are the only techniques currently available which are considered to be humane ways of killing badgers.

5.40. Cage-trapping and shooting of badgers has been used for many years by Defra and previously MAFF. There is strong evidence from its use in the field that it is effective and humane^{xv}. It was the technique used for the removal of more than 11,000 badgers in the RBCT.

5.41. Controlled shooting is a technique already widely used by the rural and pest-control communities. The main body of evidence on controlled shooting is from the

2006 report of the Game Conservancy Trust²⁰. It is commonly used to kill foxes (at night) and deer (day time) and the evidence has been extrapolated for controlled shooting of badgers. Controlled shooting is also used in countries where badgers are routinely hunted and killed, such as Germany, Sweden and Finland.

- 5.42. We are confident that controlled shooting will be an effective and humane shooting method given its widespread use in other species. However, in response to concerns about the lack of evidence on this, we propose to take a precautionary approach by piloting the policy in two areas initially. The pilot will test our assumptions about the effectiveness (in terms of removing 70% of badgers from the cull area over six weeks) and humaneness of controlled shooting. The design and evaluation of the pilots will be overseen by a panel of independent experts, whose role will include overseeing the design of the data collection, its analysis and interpretation. A decision on further roll-out of a policy that allows controlled shooting will be made following evaluation of results from the six weeks of culling.
- 5.43. Both control methods must be carried out with due regard to animal welfare. For cage-trapping and shooting the badgers must not be left in cages for prolonged periods, or subjected to unacceptable climatic conditions (see paragraphs 5.32 - 5.33 on closed seasons), and must be dispatched cleanly and rapidly in a way that avoids “any unnecessary excitement, pain or suffering” as required under the Animal Welfare Act 2006. Operators will need to demonstrate appropriate competence (see paragraph 5.47).
- 5.44. The weapons and ammunition to be used will be stipulated in the licence and must comply with the requirements of the Protection of Badgers Act and Wildlife and Countryside Act 1981. The licence may also stipulate any other restrictions on the types of weapon and ammunition that may be used which they consider appropriate. Weapons will be limited to ensure they are powerful enough with suitable ammunition to ensure a humane kill. Any person carrying out culling under licence must be in possession of the appropriate firearm certificate.
- 5.45. Only frangible cartridges (fired from shot guns) complying with the specifications previously tested and approved by Defra for killing badgers will be allowed for shooting cage-trapped badgers. Frangible or ‘reduced hazard’ ammunition minimises the risks to the operator. This will give a humane kill at close range, but is designed to disintegrate on impact.
- 5.46. For controlled shooting, the licence will stipulate a maximum range at which badgers can be shot with rifles. Shots should only be taken from a distance and position at which the shooter is confident of hitting the target area. The use of shot guns will be restricted to very short range because of their limited power.

²⁰ The Game Conservancy Trust. 2006. *Shooting as a potential tool in badger population control. Report to Defra.* <http://archive.defra.gov.uk/foodfarm/farmanimal/diseases/atoz/tb/documents/badger-gct0806.pdf> .

- 5.47. To ensure that culling is both effective and humane, those carrying out the culling will need the appropriate skills and qualifications to demonstrate their competence. Due to the anatomical and behavioural differences between badgers and other commonly killed species (e.g. deer, foxes) there will be a specific training course and marksman test for badgers (including shooting in low-light conditions). Persons despatching badgers in cage traps will also be required to attend an appropriate training course on the humane shooting of badgers in cage traps.
- 5.48. Furthermore, those licensed will be required to have contingency plans in place to be able to increase effort, or change the control method used in case the strategy described in the Badger Management Plan proves to be ineffective at removing the required number of badgers.

d) All badger carcasses must be disposed of in line with Animal By-Products Regulation 1069/2009/EC.

- 5.49. The Animal By-Products Regulation 1069/2009 lays down health rules concerning animal by-products (ABPs). The regime divides ABPs into three categories, according to the degree of risk which they pose, and specifies the permitted treatment or disposal routes for each category. Wild animals normally fall outside the scope of the Regulation, but when they are “suspected of being infected with diseases communicable to humans or animals,” they fall within the list of Category 1 materials (Article 4(1)(v)). Bovine TB is a zoonotic disease and therefore the carcasses of any badgers that are suspected of harbouring the disease fall within the definition of Category 1 ABPs.
- 5.50. Category 1 materials are required to be collected, transported and identified without undue delay and either incinerated in an approved incineration plant or processed in an approved rendering plant, with the processed products being finally disposed of as waste by incineration or burial in an approved landfill. Burial without first processing is not a permitted disposal route for Category 1 material in this instance.

Other considerations

5.51. In addition to ensuring that the criteria and conditions of licensing have been or will be met, Natural England will also take into account other considerations in deciding whether it is appropriate to issue a licence:

Natural England should aim to ensure that culling “will not be detrimental to the survival of the badger population concerned” within the meaning of Article 9 of the Bern Convention on the Conservation of European Wildlife and Natural Habitats, and for this purpose in considering applications for a licence should have regard to the guidance of the Standing Committee on the interpretation of Article 9 of that Convention.²¹ For that purpose Natural England should:

- a) determine appropriate area-specific licence conditions; and
- b) set a maximum number of badgers to be removed from the licence area.

5.52. Badgers are a protected species under the Convention of European Wildlife and Natural Habitats (1979) (known as the Bern Convention). The Convention requires contracting parties to take appropriate legislative and administrative measures to ensure the protection of badgers. Article 9 of the Convention allows parties to make exceptions to this for various purposes, but only provided that the exception will not be detrimental to the survival of the population concerned.

5.53. To limit the impact of the policy on badger populations, there will be limits on both the number of licences that may be granted in any one year and the number of badgers that may be removed in each licensed area.

5.54. The number of licences to be granted each year will be limited to ten (with a maximum of two granted initially in the first year in order to confirm the effectiveness and humaneness of controlled shooting), unless there are compelling reasons to increase or decrease that number. Applications will be prioritised according to the extent to which they best meet the primary aim of the policy (i.e. to control TB in cattle). We do not consider it appropriate to limit the number of licences granted in any given year to any less than ten as this will limit the effectiveness of the policy in achieving reductions of TB incidence in cattle.

5.55. The licence will also specify the maximum number of badgers that may be removed from the control area each year, to ensure that some badgers remain in the control area and that recolonisation is possible. Following intensive badger removal operations, badgers migrate quickly to fill gaps left by removed or substantively depleted social groups. The time taken to re-establish a population similar to that prior to any culling will vary^{xvi} depending on the length and efficiency of culling, and the permeability of the edge of the culled area.

²¹ The current guidance is dated 27 October 2010, document T-PVS/Inf (2010) 16.

5.56. We consider that these limits (on the number of licensed areas and the number of badgers to be removed in each area), together with the general safeguards within the policy to avoid culling being detrimental to the survival of the badger population in licensed areas (such as the monitoring programme), are sufficient to be confident that culling will not be detrimental to the survival of the relevant population of badgers. Therefore, we consider further measures to be unnecessary and, given the scientific evidence on the contribution that badger culling can make to reducing the incidence of TB in cattle, do not wish to introduce further safeguards which would limit the contribution that the policy can make to effective disease control.

5.57. Defra will report to the Standing Committee established under the Bern Convention every two years on the exceptions made in relation to badger culling.

Conservation considerations must be taken into account for designated sites, for example Sites of Specific Scientific Interest (SSSIs), Special Areas of Conservation (SACs), and Special Protected Areas (SPAs) sites. Under the Conservation of Habitats and Species Regulations 2010 (SI 2010/490), an “appropriate assessment” must be carried out before granting a licence which might have a significant effect on a European protected site.

5.58. There are potential ecological consequences of the badger control policy on sites and species protected and/or identified as important on a European and domestic level. The main legislative requirements that may apply are those in Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (the “Habitats Directive”) and Council Directive 2009/147/EC on the conservation of wild birds (the “Birds Directive”), and implementing regulations under which the UK has designated Natura 2000 (or European) sites which receive a high level of protection in domestic and European law. The Wildlife and Countryside Act 1981 and subsequent legislation impose a series of requirements on the protection of sites and species (e.g. Sites of Special Scientific Interest (SSSIs)).

5.59. The Habitats Directive provides for the protection of habitats and species of European importance. Natural England will undertake a screening exercise to determine whether the application may have a significant effect on a protected European site. Unless such an effect can be ruled out they will carry out an appropriate assessment of each application. The policy aim will be generally only to issue licences where Natural England are confident that any adverse impact on protected sites can be avoided by means of licence conditions. But Natural England cannot exclude the need in particular circumstances to consider whether culling might be justified despite a risk of an adverse effect on a protected site, since the Directive permits such consideration in cases where there are “imperative reasons of overriding public interest” and no alternative solutions, unless the species that may be affected are priority species (as defined by the Directive). A cull which might affect a protected site hosting priority species could only proceed if the European Commission had advised that it could.

5.60. We have undertaken an ecological impact evaluation (see paragraph 4.22) to ensure that the licensed action, irrespective of where it is carried out, will not have an adverse effect on the favourable conservation status of any habitat type or species within its natural range.

Vaccination

5.61. BadgerBCG is a prescription-only veterinary medicine and lay vaccinators must possess a valid Certificate of Competence to vaccinate badgers. In order to cage trap and vaccinate badgers, an individual must have:

- attended and passed the Fera training course in Cage Trapping and Vaccination of Badgers;
- applied to Fera for and received the Certificate of Competence; and
- applied for and received a Natural England license to trap badgers for the purpose of vaccination (they must already be accredited and certified in order to be issued a licence).

5.62. The Guidance to Natural England sets out recommended best practice for the use of vaccination in combination of culling. These recommendations will not form part of the licence conditions, but adherence to them will maximise the benefits of the control operations.

Where the use of vaccination in combination with culling is proposed, the following best practice is recommended:

- a) where vaccination is to be used as a buffer, it should be used at active badger setts found on, or adjacent to, land where vulnerable livestock are present and which fall within 2km of the edge of a control area;
- b) vaccination should take place at least 4 weeks prior to culling to allow immunity to develop in uninfected vaccinated animals;
- c) to mitigate any ongoing perturbation effect and begin to build up “herd immunity”, vaccination should be carried out annually, continuing for at least the same length of time as any culling on adjacent land; and
- d) where culling and vaccination are taking place on adjacent land, applicants should take reasonable steps to negotiate an agreed approach to badger control operations along the relevant boundary with that landowner/occupier.

5.63. Where vaccination is used in combination with culling, to provide an effective buffer, vaccination will need to cover the entire 2km width of the proportion of the boundary where perturbed badgers are a risk. The taking of badgers for the purposes of vaccination will not be permitted during a closed season which will operate from 1 December to 30 April.

- 5.64. Vaccination will be most effective where it is being used to mitigate any potential risks from culling on adjacent land once 'herd immunity' has been developed, which is likely to be after a period of several years. Defra veterinary and scientific advice is that, to have the greatest effect, vaccination should take place sufficiently in advance of any culling to allow immunity to develop in vaccinated animals. While the experimental data to support the BadgerBCG licence only tested protection from challenge with *M. bovis* after 17 weeks, we know that Badger BCG is able to induce a measurable immune response by two weeks after vaccination. However, there is no scientific data which categorically supports a specific length of time other than 17 weeks. To balance the development of protection in individual badgers with the practicalities of delivering a cull, vaccination should take place at least 4 weeks before culling commences.
- 5.65. Evidence from the RBCT post-trial analysis shows that the rise in cattle TB incidence observed in the adjacent 2km ring around a culled area, (the perturbation effect), had disappeared by 12-18 months after culling stops. However, it is not clear at what point during culling or between culls perturbation in badgers is no longer seen, only that the perturbation effect had disappeared by 12-18 months after culling had stopped. As well as reducing risks from perturbation, vaccinating annually on non-participation land throughout any culling should also have independent disease-control benefits, as herd immunity should begin to develop.

6. Monitoring and Policy Evaluation

- 6.1. As noted at paragraph 5.3 above, controlled shooting will be piloted in two areas initially in the first year in order to test our assumptions about the humaneness, effectiveness and safety of this control method. Culling will be closely monitored in these two areas. The monitoring will be overseen by a panel of independent experts, who will advise on the appropriate methods for monitoring effectiveness and humaneness. The panel will also use feedback from those undertaking field observations to confirm that controlled shooting is safe and consider whether any amendments to the training and best practice are necessary.
- 6.2. We are also putting in place arrangements to monitor the impacts of the policy. These monitoring arrangements will apply in both the pilot areas, and in other areas if the policy is rolled out more widely. The components of this monitoring will be:
- i) changes in the incidence of TB in cattle;
 - ii) the presence of remaining badger population(s) following culling; and
 - iii) the humaneness of the culling methods used; and
 - iv) compliance with licence conditions (undertaken by Natural England).
- 6.3. Incidence of bovine TB in cattle is already routinely monitored. An exploratory analysis of data gathered from licensed areas and suitable comparative control areas will look for any changes in trends that might be attributable to badger control. It should be

Department for Environment, Food and Rural Affairs

noted that this is not the same as a large randomised control trial of the impact of culling on cattle TB incidence as carried out in the RBCT.

- 6.4. This exploratory epidemiological monitoring will help evaluate and inform our understanding of the impact of badger control on TB in cattle. It will provide evidence of changes in each area where licensed badger control is taking place, differences between licensed areas and, where possible, suitable comparison areas, and differences in the incidence of cattle TB in licensed areas compared to national trends. Changes in the incidence of TB in cattle will be reported, relative to historical incidence within the culled area, and relative to an un-culled comparison area.
- 6.5. Monitoring the remaining presence of badgers in culled areas will assist with meeting our legal obligation under the Bern Convention to report on derogations made under it. The monitoring will highlight any signs that the local population may be at risk, and allow us to take actions to avoid this (e.g. stopping activity under the licence for the remainder of that season).
- 6.6. Humaneness of the culling methods used will be ensured by following the Best Practice Guidance. Alongside this we will monitor both culling methods throughout the culling period to ensure standards are maintained. This monitoring will be carried out through veterinary assessment based on field observations and post-mortem examination of a selection of carcasses. This will be informed by the study of humaneness carried out in the pilot areas.
- 6.7. We will not, however, report on the prevalence of TB in culled badgers. Data already exists from the RBCT on the likely range of prevalence in badgers in high TB incidence areas. There is no reason to believe that values in licensed areas would be significantly different from the RBCT data. Measuring prevalence of TB would add significant cost to the monitoring work which does not represent good value for money.
- 6.8. As part of their licensing operation, Natural England will monitor compliance with licence conditions, including numbers of badgers removed. Natural England will also undertake site visits to check compliance with conditions of culling. This operational monitoring will also contribute to the monitoring of humaneness and badger populations in licensed areas.
- 6.9. The Government does not want to see culling continuing for any longer than necessary. Four years after the first culling licence has been granted, the Government will review the policy and advise Natural England whether further culling licences should be granted. Natural England should continue with normal licensing operations until it receives this advice. (Existing licences will remain valid for the term for which they were originally granted).

7. Conclusion

- 7.1. Bovine TB is a pressing animal health problem and we do not believe that maintaining the current approach to disease control is sufficient. As part of a package of measures, we need to tackle the reservoir of disease in badgers while continuing and strengthening our efforts to tackle cattle-to-cattle transmission. The measures currently available to farmers to reduce the transmission of bovine TB from badgers to cattle are biosecurity measures and vaccinating badgers using an injectable vaccine. We have come to the conclusion that these do not currently represent a satisfactory alternative to badger culling and that no satisfactory alternative is likely to be available in the foreseeable future.
- 7.2. The scientific evidence from the RBCT suggests that proactive badger culling, done on a sufficient geographical scale, in a widespread, co-ordinated and efficient way, and over a sustained period of time of at least four years, is likely to reduce the incidence of bovine TB in cattle in high incidence areas.
- 7.3. Badgers are a protected species, but they are not endangered in England. We do not want to see culling continue for any longer than is necessary, but have concluded that culling is a proportionate response to the problem of TB in cattle. Our judgment is that badger culling is justified by the expected net benefit in terms of a reduction of TB incidence in cattle, even taking into account the number of badgers likely to be culled. The available evidence suggests that this net benefit in the reduction of TB incidence in cattle can be achieved if culling is conducted in line with the licence conditions outlined above, which are firmly based on the evidence from the RBCT.
- 7.4. The Government's policy is therefore to enable farmers and landowners to cull and/or vaccinate badgers under licences granted under the Protection of Badgers Act 1992 and Wildlife and Countryside Act 1981.
- 7.5. Where we have departed from the methods used in the RBCT, primarily in adopting an industry-led approach and permitting the use of controlled shooting, we are taking a precautionary approach to implementing the policy, initially licensing two pilot areas in the first year to test our assumptions about the effectiveness, humaneness and safety of controlled shooting. The initial six-week period of culling in these areas will be monitored closely, and overseen by an independent panel of experts. The policy will only be rolled-out more widely if the evaluation of the pilots confirms that culling using controlled shooting can be carried out effectively, safely and humanely.

References

- ⁱ <http://www.defra.gov.uk/publications/files/pb13601-bovinetb-eradication-programme-110719.pdf>
- ⁱⁱ Bourne, J., Donnelly, C.A., Cox, D.R., Gettinby, G., McInerney, J.P., Morrison, W.I., & Woodroffe, R. (2007). *Bovine TB: the scientific evidence* Defra
http://webarchive.nationalarchives.gov.uk/20090330154646/www.defra.gov.uk/animalh/tb/isg/pdf/final_report.pdf, London
- ⁱⁱⁱ Donnelly, C.A. & Hone, J. (2010). *Is there an association between levels of bovine tuberculosis in cattle herds and badgers?* *Statistical Communications in Infectious Diseases* 2 (1).
- ^{iv} Fera model: <http://archive.defra.gov.uk/food-farm/animals/diseases/tb/documents/8control-strat-report.pdf>
- ^v Donnelly, C.A., Woodroffe, R., Cox, D.R., Bourne, J., Gettinby, G., Le Fevre, A.M., McInerney, J.P., & Morrison, W.I. (2003) *Impact of localized badger culling on TB incidence in British cattle*. *Nature*, 426, 834-837
- ^{vi} Cox, D.R., et al, *Simple model for tuberculosis in cattle and badgers*, PNAS December 6, 2005 vol. 102 no. 49 17588-17593
- ^{vii} Abernethy, D. A., Denny, G. O., Menzies, F. D., McGuckian, P., Honhold, N., Roberts, A. R. (2006). The Northern Ireland programme for the control and eradication of *Mycobacterium bovis*. *Veterinary Microbiology* 112, 231-237.
- Donnelly, C.A., Woodroffe, R., Cox, D.R., Bourne, F.J., Cheeseman, C.L., Wei, G., Gettinby, G., Gilks, P., Jenkins, H., Johnston, W.T., Le Fevre, A.M., McInerney, J.P., & Morrison, W.I. (2006). *Positive and negative effects of widespread badger culling on cattle tuberculosis*. *Nature*, 439, 843-846.
- Donnelly, C.A., Wei, G., Johnston, W.T., Cox, D.R., Woodroffe, R., Bourne, F.J., Cheeseman, C.L., Clifton-Hadley, R.S., Gettinby, G., Gilks, P., Jenkins, H.E., Le Fevre, A.M., McInerney, J.P., & Morrison, W.I. (2007). *Impacts of widespread badger culling on cattle tuberculosis: concluding analyses from a large-scale field trial*. *International Journal of Infectious Disease*, 11, 300-308
- Donnelly, CA & Hone, J. (2010). *Is there an association between levels of bovine tuberculosis in cattle herds and badgers?* *Statistical Communications in Infectious Diseases* 2 (1). <http://www.bepress.com/scid/vol2/iss1/art3/>,
- Good, M. (2006). Bovine Tuberculosis eradication in Ireland. *Irish Veterinary Journal* 59, 154-162.
- Griffin, J. M., Williams, D. H., Kelly, G. E., Clegg, T. A., O'Boyle, I., Collins, J. D., More, S. J. (2005). The impact of badger removal on the control of tuberculosis in cattle herds in Ireland. *Preventive Veterinary Medicine* 67, 237-266.
- More, S. (2009). What is needed to eradicate bovine tuberculosis successfully: an Irish perspective. *The Veterinary Journal* 180, 275-278.
- Naranjo, V., Gortazar, C., Vicente, J., and de la Fuente, J. (2008). Evidence of the role of European wild boar as a reservoir of *Mycobacterium tuberculosis* complex. *Veterinary Microbiology* 127, 1-9.
- Nishi, J. S., Shury, T., Elkin, B. T. (2006). Wildlife reservoirs for bovine tuberculosis (*Mycobacterium bovis*) in Canada: strategies for management and research. *Veterinary Microbiology* 112, 325-338.
- O'Brien, D. J., Schmitt, S. M., Fitzgerald, S. D., Berry, D.E., Hickling, G.J. (2006). Managing the wildlife reservoir of *Mycobacterium bovis*: the Michigan, USA, experience. *Veterinary Microbiology* 112, 313-323.
- Ryan, T. J., Livingstone, P. G., Ramsey, D. S. L., de Lisle, G. W., Nugent, G., Collins, D. M., Buddle, B. M. (2006). Advances in understanding disease epidemiology and implications for control and eradication of tuberculosis in livestock: The experience from New Zealand. *Veterinary Microbiology* 112, 211-219.
- ^{viii} The Impact assessment is available at: <http://www.defra.gov.uk/animal-diseases/a-z/bovine-tb/badgers/>

^{ix} Professor Quintin McKellar, chair of Defra's bovine TB Science Advisory Body

^x Crawshaw et al (2008). Comparison of a standard and a detailed post-mortem protocol for detecting *M. bovis* in badgers. *Veterinary Record* **163**:473-477

^{xi} Based on further analysis of the model in the Donnelly and Hone 2010 paper (pers comm. Christl Donnelly).

^{xii} Reference Suppl Information for Donnelly CA, Gao W, Johnston WT, Cox DR, Woodroffe R, Bourne FJ, Cheeseman CL, Clifton-Hadley RS, Gettinby G, Gilks P, Jenkins HE, Le Fevre AM, McInerney JP and Morrison WI. Impacts of widespread badger culling on cattle tuberculosis: concluding analyses from a large-scale field trial. *International Journal of Infectious Diseases* 11, 300-308, 2007. Published online 22 June 2007. DOI: 10.1016/j.ijid.2007.04.001

^{xiii} Smith, G. C., McDonald, R. A., & Wilkinson, D. (in preparation). Comparing Badger (*Meles meles*) Control Strategies for Reducing Bovine TB in Cattle in England.

^{xiv} Smith, G.C., Cheeseman, C.L., *Efficacy of trapping during the initial proactive culls in the randomised badger culling trial*, *Veterinary Record* (2007) 160, 723-726

^{xv} Woodroffe, R., Bourne, F.J., Cheeseman, C.L., Cox, D.R., Donnelly, C.A., Gettinby, G, McInerney, J.P., & Morrison, W.I. (2005) . Welfare of badgers (*Meles meles*) subjected to culling: patterns of trap-related injury. *Animal Welfare* 14: 11-17.

Woodroffe, R., Bourne, F.J., Cheeseman, C.L., Cox, D.R., Donnelly, C.A., Gettinby, G, McInerney, J.P., & Morrison, W.I. (2005). Welfare of badgers (*Meles meles*) subjected to culling: development and evaluation of a closed season. *Animal Welfare* 14: 19-25.

^{xvi} Jenkins, H. E., Woodroffe, R. & Donnelly, C. A. (2010) The duration of the effects of repeated widespread badger culling on cattle tuberculosis following the cessation of culling. *PLoS One* 5, e9090