



Animal &
Plant Health
Agency

Bovine Tuberculosis in England in 2016

Edge area summary descriptive epidemiology report

September 2017

TB Edge Area Whole and Part Counties



September 2017



© Crown copyright 2017

You may re-use this information (excluding logos) free of charge in any format or medium, under the terms of the Open Government Licence v.3. To view this licence visit www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ or email PSI@nationalarchives.gsi.gov.uk

This publication is available at www.gov.uk/government/publications

Any enquiries regarding this publication should be sent to us at

Department of Epidemiological Sciences
Animal and Plant health Agency
Weybourne Building, Level 2, Area E
Woodham Lane, Addlestone, Surrey, KT15 3NB

TBSecretariat@apha.gsi.gov.uk

www.gov.uk/apha

Contents

1. Executive Summary.....	4
2. Introduction.....	5
3. Level of TB in the Edge Area.....	6
4. Source of infection.....	9
5. Method of detection.....	11
6. Wider risks identified.....	12
Spread to LRA.....	12
Public Health Risk.....	13
Prospects for progress towards OTF status.....	13
7. Key issues identified from review of Edge Area annual epidemiology reports.....	14
8. Executive summaries from individual county reports.....	15
Appendices.....	1
Appendix 1: Edge Area objectives and controls.....	1
Appendix 2. Epidemiological parameters.....	3

1. Executive Summary

- a. This report summarises the main features of the bovine tuberculosis (TB) epidemic in 2016 in the Edge area, established in January 2013 and part of the Government's strategy to achieve Officially Bovine Tuberculosis Free (OTF) status for England by 2038. The report discusses county differences and is derived from detailed reports for each of the eleven counties or part counties that make up the Edge Area. Throughout the report part counties are identified by the county name prefixed by an asterisk (e.g. *Cheshire).
- b. The TB epidemic continues to increase in the Edge Area with the annual incidence (per 100 OTF herds tested) across the whole Edge Area up from under 5% to over 6%. This is driven particularly by increases in *Oxfordshire, which now has the highest incidence in the Edge Area, as well as Leicestershire and Nottinghamshire. In *East Sussex there was a notable reduction in incidence; the remaining counties/part-counties have shown slight increases or a plateau.
- c. In all counties, but particularly *Oxfordshire and Hampshire, infection was introduced to many of the affected herds as a result of purchase of (undisclosed) infected cattle, usually from the High Risk Area (HRA), but also other parts of the Edge Area. Exposure to infected badgers or contamination from them was also believed to play a role in eight of the 11 counties, particularly *Cheshire and Leicestershire.
- d. Overall numbers of incidents remained low in most counties/part counties in the Edge Area compared to the HRA, with most having less than 25 in 2016. However *Cheshire continues to dominate due to its much greater population of cattle, in 2016 *Cheshire incidents accounted for 116 of the 381 TB incidents in the Edge Area.
- e. The Eradication Strategy objective is to reduce incidence and prevalence progressively, to achieve OTF status on a county basis. Review of recent history and the 2016 data suggests possible candidate counties for OTF status in the near future are Buckinghamshire and *East Sussex. Those with longer term potential for OTF status include Nottinghamshire and Northamptonshire, although management of the risk from undisclosed infection in purchased cattle needs to be improved for this to happen. The latter also has areas of higher incidence, likely due to infection in badgers, which must be reversed. Levels of disease in the other Edge Area counties (Berkshire, *Cheshire, *Derbyshire, Hampshire, Leicestershire, *Oxfordshire, *Warwickshire) are currently too high for them to be considered for OTF status .

- f. In most counties there is evidence that infected herds are being discovered sooner after infection is introduced than in the past, indicating some success in control measures. However the increasing incidence in some counties and specific evidence in this report (e.g. the significance of inconclusive reactors) confirms the need for additional controls, including those planned to be introduced in 2017
- g. The particular challenges highlighted by this report include:
- Purchase of infected animals as a substantial contributor to the epidemic
 - Inconclusive reactors as an important predictor of TB infection in most counties, supporting the planned increased controls on them. Further epidemiological study is underway into herds where IRs are disclosed.
 - Clusters of cases in several localities are likely to be driven by badger infection, but may have multiple sources and need better exclusion of a cattle source risk pathway.
 - Endemic areas reflecting local spread of TB and likely wildlife infection are emerging in *Warwickshire, north east Leicestershire, and the Hampshire/Berkshire border, and continue to cause concern in *Cheshire, *Derbyshire and *Oxfordshire

2. Introduction

This report describes progress with control of bovine tuberculosis (TB) in the Edge Area of England, which forms a boundary area between the High Risk Area (HRA) (Figure 1), and which has a comparatively high level of TB, and the Low Risk Area (LRA) which has a very low level and is likely shortly to achieve OTF status. The Edge Area objectives and controls are described in Appendix 1.

It presents the surveillance data about TB incidents throughout the Edge Area in 2016 and provides comparative analysis of key indicators between the counties and part-counties (identified by a pre-fixed asterisk e.g. *Cheshire) that form this Area. The report also describes the challenges of control in the Edge Area and makes recommendations.

Finally the report includes the Executive Summary from each of the individual county or part-county descriptive epidemiology reports, from which it is compiled.

Note this report is derived from raw data downloaded early in the year in order to provide an earlier view of the epidemic, so provides a high level picture but with less

accuracy than the England TB Epidemiology report. The latter is produced later in the year from data that is more complete and has undergone more extensive cross checks and analysis.

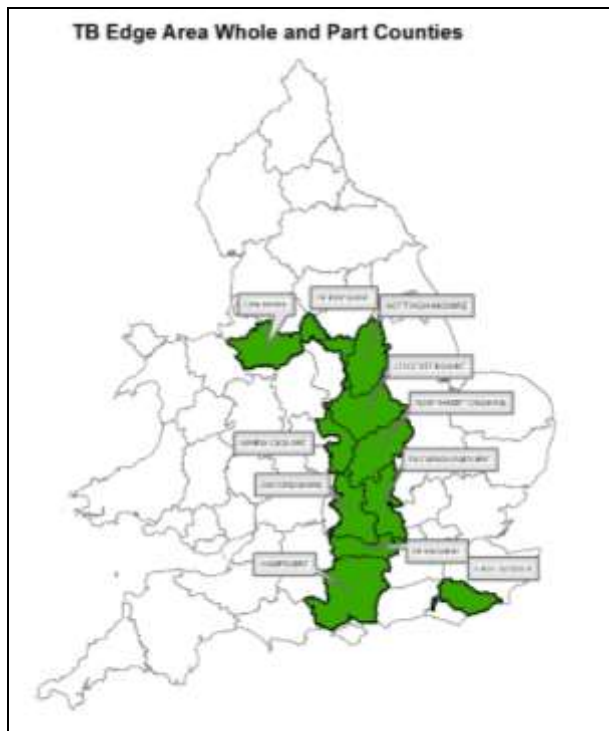


Figure 1. Edge Area counties and part counties

3. Level of TB in the Edge Area

Across the whole Edge Area the 2016 incidence¹ was just over 6%, up from under 5% in 2015, however there was wide variation between counties. The incidence in each county or part county is shown in Figure 2, and ranged from a high of over 14% in *Oxfordshire down to under 3% in *East Sussex.

¹ Incidence presented here is calculated from the number of herds newly diagnosed with TB in 2016 per 100 TB free herds tested in 2016 and includes both strongly suspected and fully confirmed incidents. The value gives a percentage probability that any unrestricted herd tested in that (part) county in that year would be diagnosed with TB. It does not adjust for frequency of testing or other confounding factors so is less accurate and may underestimate the true rate of infection in these counties. Adjusted estimates are presented in the later annual England epidemiology report.

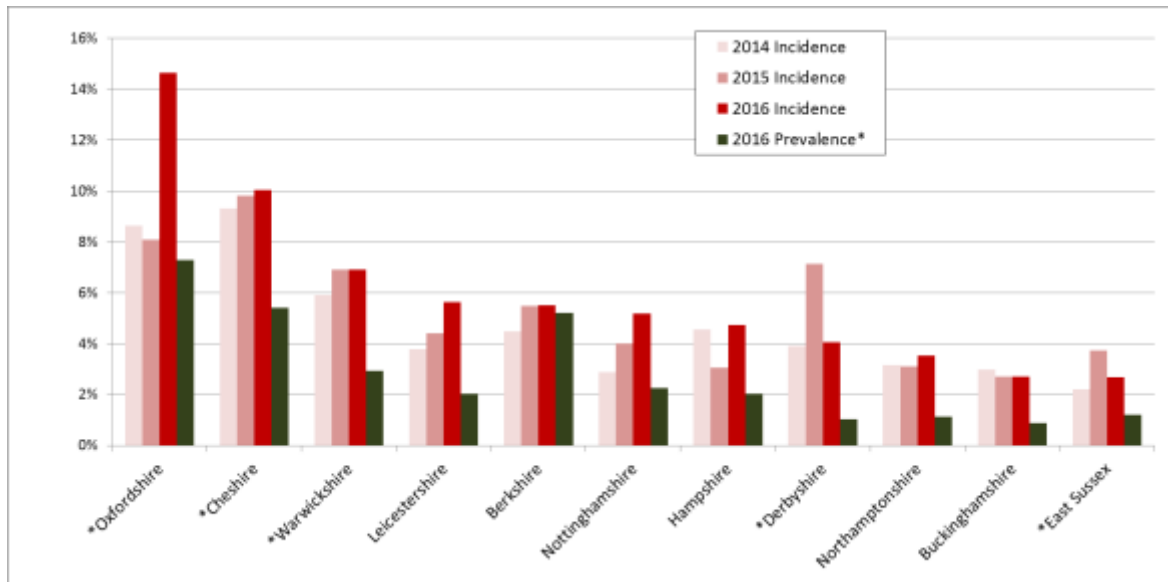


Figure 2. Edge county annual incidence 2014 - 16 and 2016 end-year prevalence

(Counties shown in order of highest to lowest incidence in 2016; *part county. Given current policy and effective removal of infection, the end-year prevalence value should ideally be less than half the annual incidence value for each county/part county)

The incidence in all counties remains above the level defined by the EU for OTF status, namely <math><0.1\%</math> annual fully confirmed ('OTFW') incidence coupled with 99.9% of herds having remained OTF for at least six consecutive years (equates to an end-year prevalence of <math><0.1\%</math>).

The incidence has increased in eight of the 11 counties/part-counties in the Edge compared to 2015, in four counties (*Cheshire, Berkshire, Northamptonshire and Buckinghamshire) only slightly and likely to reflect a plateau. However in *Oxfordshire the incidence has increased from 8% to nearly 15% and there have been notable increases in Leicestershire, Nottinghamshire and Hampshire.

*Oxfordshire has replaced *Cheshire as the county/part county in the Edge with the highest incidence. The increase in TB cases in 2016 is largely attributed to the introduction of infection by purchased animals, particularly animals for fattening.

The most frequently recorded source of infection in Leicestershire was wildlife (most likely infected badgers), however despite the increase in incidence, incidents were found earlier as evidenced by an increase in strongly suspected cases (OTFS) versus fully confirmed (OTFW), and a reduction in both reactor numbers and cases detected at slaughter.

The increased incidence in Nottinghamshire was mainly due to purchase of infected animals and most cases were disclosed early, as evidenced by the predominance of strongly suspected (OTFS) cases. However eight incidents (26%) were detected through slaughterhouse surveillance; such late detection increases the risk of spread of infection and warrants further investigation to establish why infection was not found by live animal testing.

The increase in Hampshire reflects a return to the level of TB seen in 2014, suggesting the fall in 2015 was not indicative of a downward trend.

In two counties, *Derbyshire and *East Sussex, the incidence has fallen; however in *Derbyshire this reflects a spike in cases in 2015 believed due to substantial environmental disturbance involving badgers around a railway, and 2016 saw a return to 2014 levels. Although the incidence in *East Sussex remains above the 2014 level, these are almost all suspect cases (OTFS) and resolved quickly. The lack of culture results means in most cases the source remains obscure, however there is little evidence to suggest wildlife infection is a major concern in the area.

Incidence has stayed the same in the remaining three counties (*Warwickshire, Berkshire and Buckinghamshire).

The prevalence at the end of 2016 in each county or part county is also shown in Figure 2. Prevalence² reflects both the incidence of new disease and the duration of restrictions, and so to some extent reflects the requirements for lifting restrictions. The duration of restrictions reflects the level of evidence required to give confidence that infection has been removed. A new policy in the Edge Area (and High Risk Area) was introduced in April 2016, requiring all incidents to have two herd tests prior to lifting of restrictions. This inevitably takes over 4 months³, so at any one time, prevalence will have a minimum value over one third of the annual (12 month) incidence, with increasing values above this suggesting a longer average duration of restrictions. This is the case with Berkshire in particular, where low incident numbers and the few persistently infected herds have a visible impact on the prevalence calculation.

The number of incidents in each Edge county/part county each year for the last 10 years is shown in Figure 3. Most have had fewer than 25 incidents a year in this period, though some have an increasing trend; however *Cheshire, Hampshire, Leicestershire and Oxfordshire each had over 40 in 2016. In terms of burden of disease, the number of incidents in the *Cheshire Edge is significantly greater than other Edge area counties.

² Prevalence is calculated as the percentage of live herds under restriction due to a TB incident at the end of the year

³ Two clear tests at 60 day intervals are required to raise restrictions so all incidents inevitably have duration of over 120 days plus time to remove reactors and complete disinfection and administrative requirements, etc.

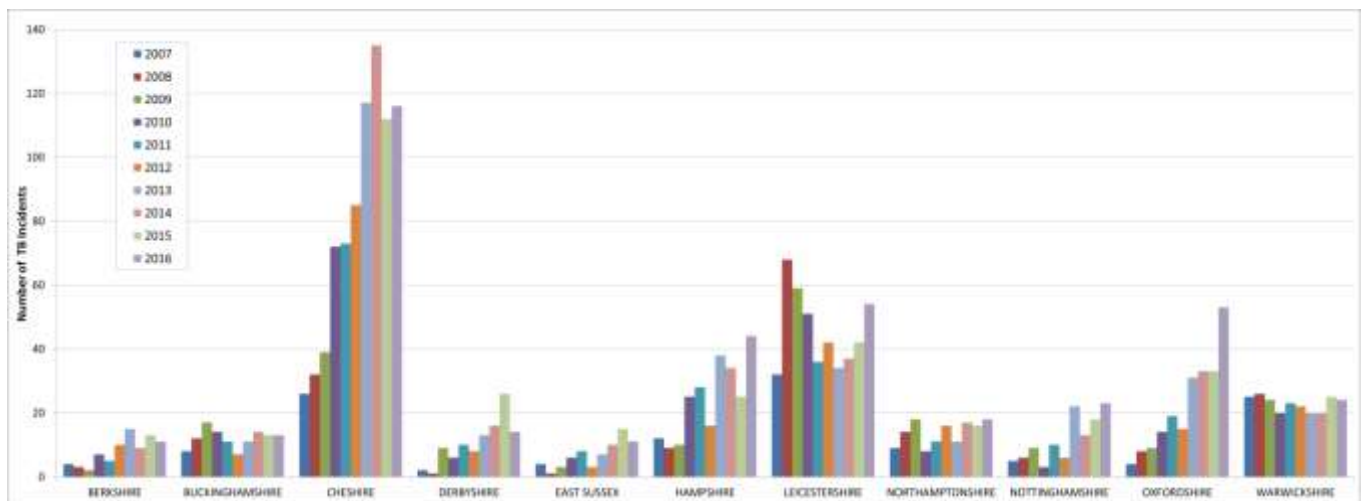


Figure 3. Number of TB incidents in each Edge county/part county, 2007-16

4. Source of infection

Sources of infection are assessed as part of the disease investigation visit into each incident by local APHA vets. Purchase of (undisclosed) infected cattle was the main source of infection for incidents in *Oxfordshire, Hampshire, Nottinghamshire and *East Sussex, and an important source for all counties except *Derbyshire. There is evidence of wildlife involvement (almost invariably badgers) in most counties and this was the predominant attributed source for *Cheshire, Leicestershire and *Derbyshire (Figure 4).

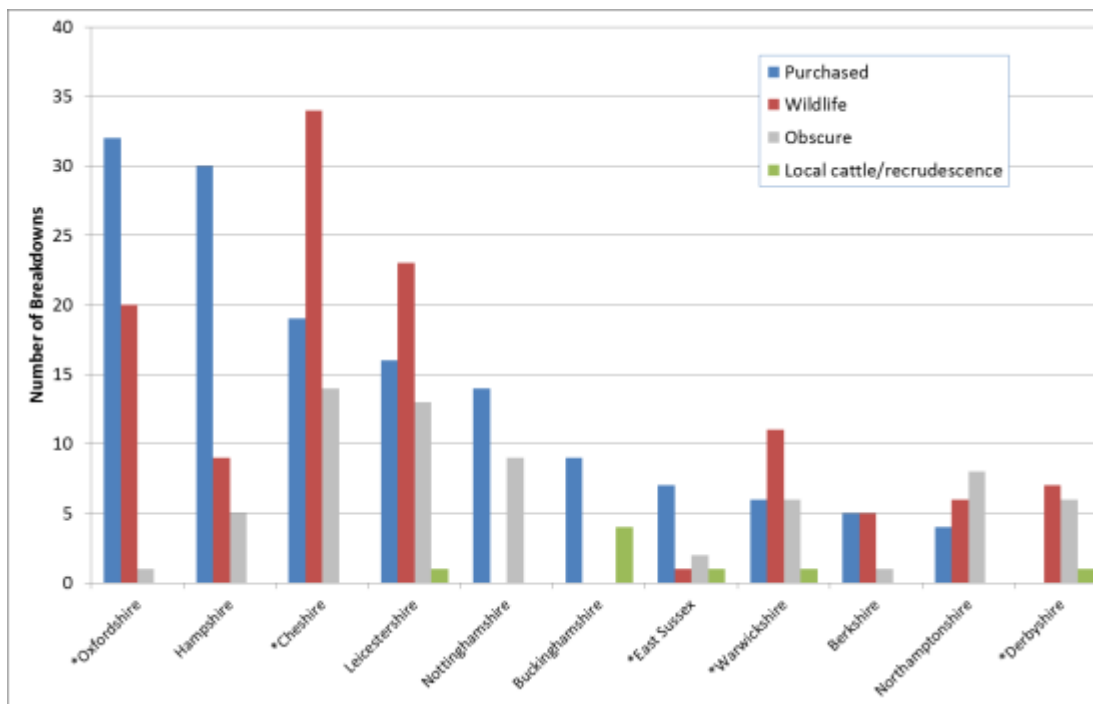


Figure 4. Source of infection by county/part county

(Ordered by decreasing numbers due to purchase; note only confirmed (OTFW) for *Cheshire, n=67; *indicates part county)

There is no evidence of wildlife infection contributing to bovine incidents in either Nottinghamshire or Buckinghamshire, and wildlife appears to now be playing little if any role in the epidemic in *East Sussex, having been a significant factor historically

Considering all the source data for the Edge Area, Figure 5 shows the important contribution from both purchased infected cattle and the risk from wildlife (mainly badger) exposure. In general purchased infection tends to be the source of incidents in beef fattener herds, while wildlife exposure is more often associated with cases in dairy and suckler herds.

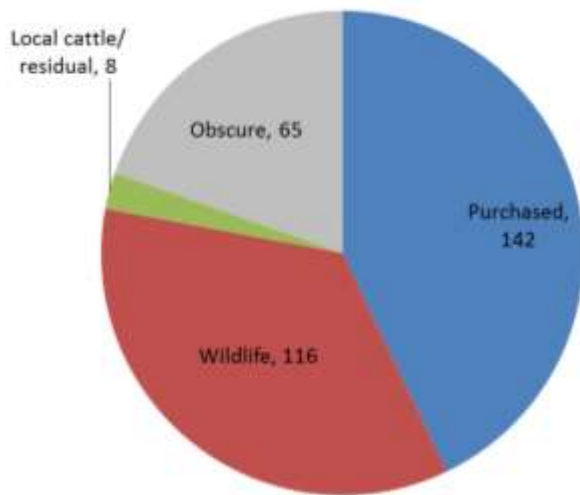


Figure 5. Relative frequency of infection sources for all Edge Area incidents in 2016 except OTFS cases in *Cheshire (n=331)

Endemic areas reflecting local spread of TB and likely wildlife infection are emerging in *Warwickshire, north east Leicestershire, and the Hampshire/Berkshire border, and continue to cause concern in *Cheshire, *Derbyshire and *Oxfordshire.

5. Method of detection

Whole herd testing was successful in detecting many of the incidents in the Edge Area, however in all counties a substantial proportion of incidents were identified following retesting of inconclusive reactors (IRs, Figure 6). This likely reflects success in finding infection earlier, so the immune response to the test is less developed. The planned policy of restricting IRs for life should help to limit spread of infection from this source to other herds.

In Nottinghamshire, *Warwickshire and *Oxfordshire slaughterhouse detection played an important role.

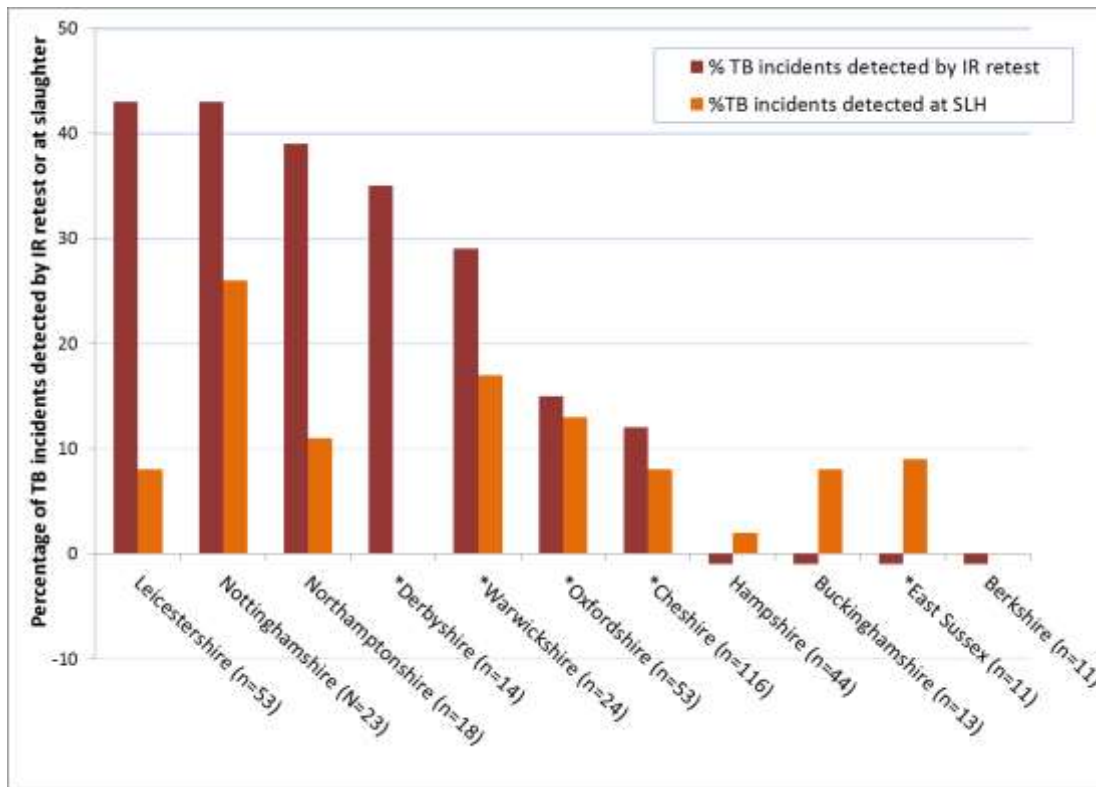


Figure 6. Percentage of incidents detected by IR retest or at slaughter

(Ordered by decreasing percentages of IRs, note y axis truncated at 50%, missing values represented as negative. *indicates part county)

6. Wider risks identified

Spread to LRA

The main risks of spread to the LRA from the Edge were identified as:

- The cluster of cases in north-east Leicestershire poses a risk to LRA in Lincolnshire
- A number of pedigree cattle breeders located in the south eastern Edge counties (including Oxfordshire) supply all risk areas, including the LRA and should be monitored in case the higher incidence areas spread to include any of them.
- Some markets may present a risk to the LRA if cattle from all risk areas are traded through them

Pre-movement testing should mitigate the latter two risks.

Public Health Risk

Overspill of infection into cats in *Cheshire and Hampshire, raised concern that there may be a low risk of further cases not being identified, as confirmation resulted from thorough investigation by the local vet, which may not always be pursued due to the cost. Raising awareness among practising vets, doctors and pet owners could help to manage this risk. Local APHA case vets are encouraged to write up unusual cases for publication.

Prospects for progress towards OTF status

The paragraphs below discuss the potential for OTF status of each county/part county in the Edge Area, however note this potential depends absolutely on improvements in the management of the risk of introduction of TB through purchase of cattle with undisclosed infection. In some counties it is also dependent on limiting and reversing the development of endemic areas of infection, which are likely related to developing endemic infection in local badger populations.

Possible candidate counties for OTF status in the near future are:

- **Buckinghamshire**, where the incidence is plateauing at a low level and the epidemic is apparently maintained by purchase of (undisclosed) infected cattle
- ***East Sussex**, where there was only one fully confirmed case (OTFW) in 2016 and this was in an AFU, and attributed to purchase of restricted cattle with undisclosed infection from the HRA. All other cases were OTFS, so evidence for their source is more limited, however only one was suspected possibly to be due to wildlife infection.

Counties showing an epidemic pattern that might enable achievement of OTF status, but in a longer timescale, are

- **Nottinghamshire** (despite increase in incidence), if improvements can be made to buying practices, and to the live animal detection rate so that cases detected at slaughter reduce, as there is no evidence of wildlife infection as a source for cattle incidents
- **Northamptonshire** could fall into this category as it has a low incidence, however buying practices need to be improved, and the apparent development of endemically infected areas needs to be reversed

Counties with little prospect of OTF status in the near or medium term due to a moderate or high incidence, likely more widespread badger infection and/or a substantial contribution from the purchase of undisclosed infected cattle.

- Berkshire, *Cheshire, *Derbyshire, Hampshire, Leicestershire, *Oxfordshire and *Warwickshire

7. Key issues identified from review of Edge Area annual epidemiology reports

Purchase of infected animals, particularly from the HRA, is a key driver for the epidemic in many counties, despite pre-movement testing. In some cases infection has been traced to young animals bought in at too young an age to be tested. In some counties the proportion of herds infected as a result of purchase has increased in 2016 compared to 2015, for example *Oxfordshire, where in addition the overall incidence has almost doubled.

Inconclusive reactors (IRs) are frequently the first sign of TB infection in Edge Area herds, and the planned policy to restrict them for life will help mitigate the risk from them. Further epidemiological study is underway to investigate herds where IRs are disclosed, also exploring this potential risk.

Presence of TB in badgers. There is evidence of TB infected badgers in some areas, (source – Cheshire 2014 survey run by University of Liverpool), and several incidents where repeated gamma tests continued to find new infection despite no cattle movements. Exposure of cattle to TB in badgers poses a substantial threat to the control strategy.

Infected badgers have been found in a specific location in the Low Risk Area (LRA) along the border with Northeast *Cheshire (the Stockport area of Greater Manchester), although no evidence has yet emerged of badger-related TB incidents in cattle herds in that area. There is also evidence of a common badger risk pathway for a cluster of infected cattle holdings in Leicestershire close to the Lincolnshire border (LRA).

Local clusters of cases are developing in a number of counties; they may be due to badger infection but the evidence is based on ruling out direct cattle contact. Additional efforts are being made to rule out and/or risk assess exposure to fomites of cattle origin.

Greater need for detailed investigation. The success of the Edge Area strategy in finding infection earlier means slaughtered animals with visible lesions are less frequently found. In consequence molecular epidemiology (which is dependent on culture of the TB organism from such animals) is possible in progressively fewer cases. This increases the dependency on observational evidence.

8. Executive summaries from individual county reports

This section presents key from the Executive Summary from each Edge Area county or part-county annual report for 2016, in alphabetical order. The full reports will be published later in the year at [Bovine TB epidemiology and surveillance in Great Britain](#).⁴

Berkshire

- a. The data for the last three years (2014 to 2016) in Berkshire is similar, incidence is the same as 2015 (5.5%) with a few dairy farms being affected.
 - Two persistently infected dairy herds in the endemic wildlife region of the county continued their incident throughout 2016.
 - One additional dairy herd became infected (confirmed, OTFW) in 2016 with genotype 9:d with an obscure origin. There is no indication of spread and all co-located camelids and other susceptible species tested negative and OTF status was regained. Given the current data, there is no indication that this is an easterly move of 9:d.
- b. The area with the highest cattle density coincides with the wildlife endemic area (genotype 10:a and 10:u). The 2015 cluster north of the A34 and M4 junction (Chieveley) continues with the two aforementioned dairies and surrounding beef units. One farm's co-located pigs had visible lesions found at slaughter. The most likely spread was determined to be either wildlife to pig or cattle to pig.
- c. Despite high risk buying/movement (45% of all incidents were of purchased origin) and endemic wildlife infection continuing, the incidence appears to have plateaued after a slight rise (4.5 to 5.5%) from 2014 to 2015.

Buckinghamshire

⁴ <https://www.gov.uk/government/collections/bovine-tb-surveillance-in-great-britain>

- a. Buckinghamshire forms part of the SE Region of the Edge Area with Oxfordshire Edge county to the west, Northamptonshire Edge county to the north, a small part of Berkshire Edge to the south and Bedfordshire/Hertfordshire/London LRA counties to the East.
- b. It is predominantly a beef rearing county with larger numbers of small farms (less than 50 cattle) but incidents affecting medium to large farms buying in cattle from market, namely Thame Market which channels cattle from the Edge and LRA, but also the HRA. Approved Finishing Units (AFUs) have contributed to a lesser number of incident testing in larger finishers and a lesser risk of spread of TB from purchased cattle from the HRA and Edge.
- c. The TB epidemic in this county has remained unchanged through the last three years, with low number of confirmed incidents evenly distributed usually north of the county where the highest cattle density lays. No clusters or emerging areas have appeared either on the border of risk counties or otherwise within the county. TB seems not to have been established in this area and appears randomly, mainly introduced through purchased cattle.
- d. There have been several cases of non-bovine TB in fox-hounds from a single hunt kennel fed on carcasses, which highlights the risk in this county of movements of cattle and carcasses from nearby counties such as Oxfordshire.
- e. The risk pathways of TB into this county remains mainly by the purchased of cattle from Edge and HRA but there is also an element of residual/recrudescence infection within some herds, often revealed by repeat testing of Inconclusive Reactors (IRs), which are never confirmed and remain of obscure origin.
- f. There is no evidence of wildlife infection and hence of badgers as a source of incidents in this county. There have not been any clusters developed or hot spot areas that could change the epidemiology of the county and cause lateral spread.
- g. OTF status could be secured for Buckinghamshire if incidence remains low, if it is protected from infection incursion from purchases of undetected infected cattle, and if wildlife remains uninfected.

*** Cheshire (Edge part)**

- a. Cheshire is predominantly a dairy county with some large dairy herds; there are also large beef fattener herds and many small suckler herds

- b. Over recent years, the incidence of bovine tuberculosis has increased dramatically in Cheshire to a level where it appears to be plateauing despite increased cattle measures especially in the East of the county.
- c. The incidence rate has increased to 10% in 2016, compared to 9% in 2015 and the prevalence has also increased. Just over 30% of all of the England Edge incidents are in the Cheshire Edge (116/383) which is a slight decrease from 2015 (33%).
- d. The occurrence and distribution of cases in 2016 follows much the same pattern as 2015 with few notable changes, except for the occurrence of some severe incidents close to Manchester airport and further south between and beyond Congleton and Macclesfield in the east of the county. There is circumstantial evidence of substantial badger activity as a contributing factor as the incidents are not associated with cattle movements or purchases.
- e. The overall numbers of incidents remains similar to 2015 (111 incidents in 2015 & 116 in 2016). The number of fully confirmed cases (OTFW incidents) has reduced by 8% in 2016 compared to 2015 whilst the number of strongly suspected cases (OTFS) has risen by 29%. This may be in part due to the fact that six monthly whole herd TB testing has completed its second year in the Cheshire Edge and disease is being detected earlier.
- f. Slaughterhouse surveillance continues to identify new incidents with no increased numbers reported. This may be indicative of the skin test sensitivity and that 56% of these were likely to be purchased animals. However, only three were genotypes not found in Cheshire (74:a, 10:a & 9:c) but they were not recently purchased cattle.
- g. The seasonal pattern in 2016 differed from 2015 with a greater proportion of incidents being disclosed in April and May when there was a 44-57% increase compared with the same period last year. There was then a reduction on 2015 proportions in June and July followed by substantial increases in August to November.
- h. 36,199 (10%) more cattle were tested in 2016 compared to 2015. Although 192 fewer herds were TB tested in 2016 compared to 2015, this could be due to the fact that some herds have been sold and others have expanded in numbers of cattle.
- i. Most (66%) of the new incidents in the Cheshire Edge area were detected by routine herd testing in 2016 and a substantial proportion (12%) were found on retesting inconclusive reactors (IRs). Farmer concern about IRs is increasing,

reflected by a case where an IR that retested clear was sent to slaughter, identified as a TB suspect, and confirmed on culture.

- j. Recurrence of infection continues to be important; 34% of all new incidents (39/116) in 2016 had a confirmed incident of TB in the previous three years which is similar to 2015 (39/111).
- k. The majority (78%) of the fully confirmed incidents were spoligotype 25 (mostly genotype 25:a), consistent with previous years; 9% were spoligotype 17; other sporadic genotypes included 74:a ,10:a, 9:c & 9:d.
- l. The final source attributed to each resolved fully confirmed case (n=31) at the end of 2016 shows that 50% were most likely attributed to exposure to infected badgers indirectly through contamination of feed or during the housing or grazing period through environmental contamination. 28% were most likely attributed to purchase of infected cattle and 22% were classed as obscure due to the fact that no genotyping was completed for these cases or could be multiple reasons. This compared with the provisional source assessment for the 67 fully confirmed (OTFW) cases in this period of 49% attributed to wildlife, 31% to purchase and 20% to obscure, equally weighted risk pathways. The badger surveys, undertaken by University of Liverpool⁵, in 2014 & 2015 have significantly contributed to the evidence of badger infection in the Cheshire Edge and the 2016 survey will further contribute to our understanding. The genotype found in badgers is consistent with that found in cattle incidents in most areas where badgers have been attributed as the source of infection (genotype 25:a). Voluntary sporadic badger vaccination has taken place in areas of Cheshire but was suspended for 2016 & 2017 due to lack of available vaccine.
- m. There were two non-bovine incidents reported in 2016 in the Cheshire Edge area both were domestic cats from residential areas in Macclesfield and Knutsford. One cat had an open tuberculous wound; however there was no evidence of spread of infection to the householder.
- n. The overall number of reactors disclosed increased in 2016 to 1100, compared with 979 in 2015 which represents an increase of almost 13%. In terms of skin reactors, in 2016 there was an increase in the disclosure of skin reactors from 496 in 2015 to 714 which represents an increase of 44%. However, the disclosure of gamma positives fell by 20% in 2016 compared to 2015 from 483 to 386.

⁵ <https://www.liverpool.ac.uk/infection-and-global-health/research/zoonotic-infections/badger-survey/welcome/>

- o. The number of reactors per incident (9) and the number of reactors per 1000 cattle tested (3) remains largely the same for 2016 & 2015.
- p. The increased cattle controls in the Cheshire Edge Area are improving early detection and likely to be preventing escalation of the epidemic; these benefits are expected to continue and to reduce overall reactor numbers over time. However, it seems likely that the epidemic will continue to plateau unless a reduction in the heavy infection challenge from infected badgers in some areas, particularly in east Cheshire, is facilitated through targeted control measures.

***Derbyshire (Edge part)**

- a. The 'Edge Area' was established in 2013 and was later incorporated into the Government's strategy to achieve Officially Bovine Tuberculosis Free (OTF) status for England by 2038. It has a low but recently rising incidence of infected farms and is divided into three regions for reporting purposes. This end of year report describes the bovine tuberculosis (bTB) epidemic in ***Derbyshire**, one of the 5 counties forming the Midlands Edge Area.
- b. **Level of bovine TB.** The incidence of bovine TB has almost halved from 7% seen in 2015 in *Derbyshire, to 4% and reflects a return to the level seen in 2014. The high level in 2015 is considered an anomaly, attributed to railway works causing unusual disturbance to badgers.
- c. **New incidents of bovine TB.** The number of incidents in 2016 decreased from 26 in 2015 to 14. This decrease was seen in both confirmed (OTFW) and strongly suspected (OTFS) incidents.
- d. **Disclosing tests.** Over half of the strongly suspect (OTFS) incidents were disclosed at an IR retest, with 2 of the 5 animals having had simultaneous reactions to both avian and bovine tuberculin at the previous test. However, this was not mirrored in confirmed (OTFW) incidents which were all disclosed at their initial test. Additionally, just under a third of incidents in the *Derbyshire Edge in 2016 were disclosed by radial testing while none were disclosed by slaughterhouse surveillance.
- e. **Risk pathways for bovine TB infection.** The infection source for half of the 14 new cases in the *Derbyshire Edge Area in 2016 was attributed to wildlife, specifically badgers, with 6 other cases being attributed to an undetermined source and 1 case being attributed to recrudescence of a previous infection. A badger infection source was the most common source attributed to dairy herd incidents and sources for beef suckler herds were equally split between either, a likely badger source or, sources that could not be determined.

- f. **Impact of bovine TB: reactor numbers.** In *Derbyshire 65% of reactors removed had been disclosed by the gamma interferon (gIFN) blood test.
- g. **Cluster – Northwest Derbyshire.** The area of the Northwest *Derbyshire cluster in 2015 had a greatly reduced number of incidents in 2016 (both suspected and confirmed, OTFS and OTFW). However, there was one new OTFW incident of genotype 25:a in the area. This suggests that disease still persists in this area, with some evidence of possible spread further north.
- h. **Cases in other species.** There have been no laboratory confirmed isolations of *M. bovis* in other species in the *Derbyshire Edge Area. Submission rates are extremely low in other domestic species. There is no systematic surveillance that would reveal such infection in badgers and other wildlife however a Defra-funded Edge Area Badger Survey is currently being conducted to look for the presence of *M. bovis* in found dead badgers in Edge Area counties.
- i. **Changes in the Epidemic.** Despite the decrease in incident numbers, there are still signs of developing endemicity in the Northwest *Derbyshire Edge Area. Industry stakeholders have been relatively inactive in Derbyshire over the last year, with no meetings of the NFU Derbyshire TB group. A new, national, industry led health certification scheme could help publicise incentives for farmers to practice risk based trading.
- j. **Risks to the LRA and from the HRA.** Remain unchanged from the 2015 year-end report.
- k. **Forward look.** Emphasis on risk-based trading, making herd/holding data available more widely to encourage industry ownership of disease control. Enhancement of badger control measures needed.

Hampshire

- a. The data for the last three years (2014 to 2016) in Hampshire, shows a large increase in incidence from 2015 (3.0 to 5.5%) and surpasses the 2014 incidence of 4.5%. 31% (5/16) of all incidents were attributed to wildlife as the infection source in 2016. There was no indication that there has been an expansion of the endemic area in the Northwest of Hampshire (along the Berkshire border); however, there were two OTFS clusters of interest in 2016:
- b. Winchester to Fawley cluster: Group of 10 incidents that do not appear to have a common cause. The group is comprised of 4 dairies, 4 suckler herds, and 2 fattening units. All except 2 have high risk purchasing histories from HRA and Edge holdings. The two without recent risky moves are currently of 'obscure' origin. Wildlife is possible, but other sources such as recrudescence from

previous incident or indirect contact via knacker yard are more likely. There is no indication that spread has occurred.

- c. West of Winchester: OTFS cluster of potential straying incidents continues into 2016. This is a group of three farms that oscillates from OTF to OTFS regularly. There is a history of straying in the areas between the three. One of the holdings, a dairy, had a confirmed incident in 2007, a suckler unit continues to have high risk buying practices from the HRA and Edge, and the third is a closed dairy with adjacent grazing.

High risk moves and buying practices from the HRA and Edge appear to be increasing. Many fatteners are now sending direct to slaughter as a business model to allow business to continue 'as usual' whether OTF or not.

Leicestershire

- a. Small beef herds predominate in Leicestershire; however there is a significant number of large dairy herds in the county.
- b. **Level of bovine TB.** The incidence of bovine TB seen in 2016 in Leicestershire has increased from 4.4% in 2015 to 5.6.
- c. **New incidents of bovine TB.** The number of incidents in 2016 has increased from 42 in 2015 to 53 in 2016. There has been a 21% reduction in confirmed (OTFW) cases from 23 in 2015 to 17 in 2016.
- d. **Disclosing tests.** The vast majority of reactors (almost 80%) are disclosed by routine annual surveillance testing. 13% of incidents have been disclosed by passive (slaughterhouse) surveillance. This is in contrast to 2015 where almost 40% of all OTFW incidents were identified at the slaughterhouse.
- e. **Risk pathways for bovine TB infection.** 43% of all incidents in 2016 were attributed to wildlife, 30 % to the movement of purchased animals and 24.5 % were unknown.
- f. **Impact of bovine TB: reactor numbers.** The number of reactors has decreased by 38% compared to 2015 with 318 reactors removed in 2015 in comparison to 223 in 2016. There has been a reduction in the number of reactors per incident from 7.5 in 2015 to 5 in 2016 and a decrease in the number of reactors per 1000 animal tests from 2.4 in the previous year to 1.78 in this reporting year. 35% of reactors were disclosed by the gamma test in 2016, compared to 63% in 2015. A reduction in the number of OTFW incidents in 2016 may have contributed to this change, as compulsory gamma testing is only applied to fully confirmed cases.

- g. **Cases in other species.** There have been no laboratory confirmed isolations of *M. bovis* in other species in Leicestershire. Submission rates are extremely low in other domestic species. There is no systematic surveillance that would reveal such infection in badgers and other wildlife however a Defra-funded Edge Area Badger Survey is currently being conducted to look for the presence of *M. bovis* in found dead badgers in Edge Area counties.
- h. **Changes in the Epidemic.** There has been an increase in both incidence and prevalence since 2014 in Leicestershire although there has been an increase in the number of incidents due to a greater number of OTFS cases mainly in the south of the county. This change in the epidemic suggests that disease is identified in early stages although incursion is not being stopped. The incidents continue to be a mixture of purchased, wildlife and undetermined origin. There is a TB cluster in the North east of Leicestershire continuing to pose a risk to the low risk area of Lincolnshire where there is clear evidence of bTB being endemic.
- i. **Risks to the LRA and from the HRA.** Remain unchanged from the 2015 year-end report.
- j. **Forward look.** Emphasis on risk-based trading, making herd/holding data available more widely to encourage industry ownership of disease control. Enhancement of wildlife control measures needed.

Northamptonshire

- a. **Level of bovine TB.** The incidence of bovine TB has increased from 3.1% in 2015 to 3.5% in 2016.
- b. **New incidents of bovine TB.** The number of cases increased by 2 (from 16 to 18 new incidents) compared with 2015. The number of strongly suspected (OTFS) cases has risen by 37.5% for the reporting period whilst the number of confirmed (OTFW) cases has decreased by 12.5% (from 8 to 7 cases). **All** the OTFW cases were disclosed within the first 6 months of 2016.
- c. **Disclosing tests.** More than two-thirds of all cases were disclosed at routine annual surveillance testing. Nearly half (45%) of the OTFS cases were disclosed at IR retest whilst this figure is much lower for OTFW cases (28%). Just under a third of the latter were detected through passive surveillance (slaughterhouse cases) and a number of these animals had shown reactions to bovine tuberculin at previous skin tests: suggestive of early stages of infection at time of testing or poor testing technique. Other enhanced surveillance tests leading to 27% of incidents disclosure were tracing (TR), contiguous (CON) and 6 month (6M) tests with the numbers of new incidents (all OTFS) equally

distributed between the three test types. The last two mentioned tests triggered OTFS cases by disclosing IRs initially.

- d. **Risk pathways for bovine TB infection.** Infection sources for the 18 cases new in the reporting period were **undetermined** in 44% of cases in all herd sizes and types, excluding dairy where the one incident recorded was attributed to **inward cattle movement**. Beef suckler herds suffered the highest number of incidents and more than half of the confirmed cases were attributed to a **wildlife source**. Beef fattener herds did not experience confirmed incidents which may be the reason for the majority of the cases for this cattle sector to have been deemed as having an unknown infection source. There is no specific trend to be noted with regards to size of the cattle herds except that wildlife source was not identified in very small (< 50) and very large (500+) herds. Inward cattle movement accounted for 22% of the incidents.
- e. **Impact of bovine TB: reactor numbers.** 181 reactors were detected in 2016, a substantial increase of (up from 108) over the number detected in 2015. 62% of reactors were identified by gIFN test in both 2015 and 2016. There were 2.94 reactors per 1000 animal tests in 2016 compared to 1.95 in 2015 (note that a proportion were found during ongoing testing of incidents that had started in the previous year).
- f. **Cases in other species.** There have been no laboratory confirmed isolations of *M. bovis* in other species. Submission rates are extremely low in other domestic species. There is no systematic surveillance that would reveal such infection in badgers and other wildlife.
- g. **Changes in the epidemic.** There has been an increase in the number of incidents and areas of endemic infection continue to be suspected. The cluster of incidents identified in Banbury parish (southwest tip of the county) in 2015 all concluded during 2016 with no new incidents occurring in the reporting period in that specific area. However there is another cluster of confirmed incidents which has formed during the reporting period, in Daventry parish, where the source of the majority of confirmed incidents was attributed to wildlife. These incidents are believed to be due to infection creep from *Warwickshire Edge and Oxfordshire North via wildlife rather than cattle movement.

Nottinghamshire

- a. **Level of bovine TB.** The incidence of bovine TB has increased from 4% in 2015 to 5% in 2016, continuing the increase seen between 2014 and 2015.

- b. **New incidents of bovine TB.** The number of incidents in 2016 increased from 18 in 2015 to 23, comprising similar increases in both confirmed (OTFW) and strongly suspected (OTFS) incidents.
- c. **Disclosing tests.** The majority of incidents (70% of total) were disclosed at active surveillance, but 88% of these remained unconfirmed. The contribution of cases disclosed at IR retest was high (59% of active surveillance cases). Both features indicate that disease is generally being detected early in its course in Nottinghamshire.

However slaughterhouse cases accounted for 26% of the total of incidents, representing 75% of the total of fully confirmed (OTFW) incidents and reflecting the increased period for disease development and spread that occurs when infection is not detected until slaughter.

- d. **Risk pathways for bovine TB infection.** 60% of 2016 incidents in Nottinghamshire were of purchased origin. The remaining 40% were assessed as of undetermined origin (mainly due to the lack of sufficient information to identify the most likely source of infection in unconfirmed incidents).
- e. **Impact of bovine TB: reactor numbers.** 65 reactors were disclosed at active surveillance (34% disclosed by gamma interferon (gIFN) blood test) while passive surveillance detected 8 slaughterhouse cases.
- f. **Clustering – 2015-2016 cumulative figures** indicate a relative accumulation of confirmed cases of undetermined source in the southern half of the county but no obvious clustering.
- g. **Cases in other species.** There have been no laboratory confirmed isolations of *M. bovis* in other species. Submission rates are routinely extremely low in other domestic species. A Defra-funded Edge Area Badger Survey is currently being conducted to look for the presence of *M. bovis* in found dead badgers in Edge Area counties.
- h. **Changes in the Epidemic.** Although there is a clear trend of increase in TB levels, there is insufficient data to suggest that there are any endemic areas, with the majority of cases being assessed as purchased origin.
- i. **Risks to the LRA and from the HRA.** Remain unchanged from the 2015 year-end report, and the main risk continues to be the movement of cattle from the HRA into Nottinghamshire to populate finishing units.
- j. **Forward look.** The potential to improve control in future depends on an emphasis on risk-based trading, making herd/holding data available more

widely to enable and encourage informed buying practices and industry ownership of disease control.

- k. **Other** A local TB eradication group was created in the Vale of Belvoir (between Leicestershire and Nottinghamshire) and was fairly active in 2016, including representatives from NFU (leading), Nottinghamshire Wildlife Trust, APHA and other stakeholders.

Defra-funded Badger Edge Vaccination Scheme (BEVS) was suspended due to the vaccine shortage; however the Nottinghamshire Wildlife Trust (NWT) continued to work in the project (surveying and engagement) and will likely resume vaccination in 2017.

A new, national, industry led health certification scheme could help publicise incentives for farmers to practice risk based trading.

***Oxfordshire (Edge part)**

- a. Two new clusters – one in north of the county in a presumed wildlife infected area and with long history of incidents, and the other near Henley-on-Thames.
- b. High uncertainty associated with source for the Henley cluster but this could represent significant spread of the presumptive wildlife infected area.
- c. Incidence risk almost doubled from 8% in 2015 to 15% in 2016, with incident numbers also increasing from 31 incidents in 2015 to 53 in 2016.
- d. The proportion of incidents attributed to purchase of infected cattle has tripled compared to 2015. Of 38 OTFW incidents, 20 were attributed to purchase of infected cattle compared to 18 attributed to wildlife (1.4 times that of 2015). The proportion is similarly high for OTFS incidents, with 12 of the 15 most likely attributed to purchase. In summary over 60% of all incidents were attributed to purchase and two thirds of these to cattle from the HRA.
- e. Source of infection by industry sector reflected the need for purchase – purchase accounting for all fatterer incidents and half of suckler and only one out of eight dairy incidents.
- f. Increase in deer source reporting – probably biased by observations of high deer populations
- g. There is no formal wildlife surveillance in Oxfordshire and badgers have never been tested, however deer are widespread and hunting for game probably provides reasonable passive surveillance of this species. Despite this there have been no wildlife confirmations since 2009 from a muntjac deer.

- h. 45% incidents detected by non-routine testing suggesting that increasing from annual to 6 monthly testing might speed up detection.
- i. Number of reactors per incident has remained unchanged at nine.
- j. The 70% increase in total number of reactors (to both skin and gamma tests) was attributed to the increased incidence.
- k. Key drivers of epidemic – purchase of infected cattle and presumed infected wildlife.
- l. The increased number of Approved Finishing Units ('AFUs', which channel riskier cattle into a controlled environment) from 3 to 5 with 2 more planned in 2017 may help mitigate the risk from purchased infected cattle.
- m. Risk to LRA from movement of cattle from *Oxfordshire increased due to higher incidence and more long term, spread of infected wildlife.
- n. Risk from HRA – movement of infected cattle, and infected wildlife.
- o. Forward look – movement controls or other methods of changing purchase behaviour, and wildlife measures, are needed. The increased focus as a result of the establishment of the proposed Eradication Board for Oxfordshire, Buckinghamshire and Berkshire should help to promote changes in purchase behaviour.

***East Sussex (Edge part)**

- a. In the Edge of *East Sussex in 2016, there was a decrease in the numbers of bTB incidents, with only one fully confirmed incident and a significant decrease in the numbers of strongly suspected incidents from 16 incidents in 2015 to 11 incidents in 2016.
- b. There is no clear clustering of incidents, with the same trend of random geographical distribution as observed in 2015. The only fully confirmed incident located on the border with the HRA area occurred in an Approved Finishing Unit (AFU).
- c. Although the *East Sussex endemic area in the HRA has existed for 25 years, the *East Sussex Edge does not appear to have any endemic fronts. Looking back to data available from 2012 to 2016, there is no clear evidence of emerging or established infected areas.

- d. One confirmed incident in the HRA of East Sussex could pose a threat to the Edge of East Sussex as the incident was attributed to infected wildlife and was located only 5 km away from the southern Edge border.
- e. The bTB incidence level in *East Sussex has decreased in 2016 to 2.6% from 3.7% in 2015.
- f. The bTB prevalence of incidents has decreased in 2014 from 3.41 to 0.6 in 2016. This reflects the bTB predisposition for small – medium size suckler and fattener herds where incidents are resolved in a shorter period of time.
- g. In 2016 no contiguous testing was carried out, reflecting the lack of confirmed incidents in this area.
- h. The pattern of infection in the *East Sussex Edge area is becoming more similar to that seen in the Low Risk Area with a high proportion of incidents strongly suspected (OTFS) rather than fully confirmed (OTFW), a low frequency of disclosure through risk based testing, and a reduced mean duration of restrictions. The lower risk in *East Sussex is also reflected by the reduced frequency of tracings of higher risk movements to holdings in the area, and all that did occur in 2016 have proved negative to date.

***Warwickshire (Edge part)**

- a. **Level of bovine TB:** the incidence level increased from 2014 to 2015 and remained constant from 2015 to 2016.
- b. **New Incidents of bovine TB:** In 2016, the total number of TB incidents dropped by 7% compared with 2015. Confirmed (OTFW) cases increased by 10% from 2015 to 2016 and strongly suspected (OTFS) cases decreased by 50%.
- c. **Disclosing test:** Routine annual surveillance testing (WHT) detected most of the OTFW incidents (44%). However there were 4 slaughterhouse cases (22% of OTFW) in the county. For OTFS cases, 67% were disclosed by “other tests”.
- d. **Risk pathways for bovine TB infection:** The main source of infection in 2015 was purchased cattle, whereas in 2016 wildlife was identified as the main source of infection (46% of cases). However, the main sources of infection in OTFS incidents were either undetermined (40%) or purchased (40%).
- e. **Impact of bovine TB: reactor numbers.** The total number of reactors dropped from 208 in 2015 to 168 in 2016. There were more skin reactors in 2016 than gamma reactors.

- f. **Cases in another species:** There have been no laboratory confirmed isolations of *M. bovis* in wild animals such as badgers, wild deer or wild boar carcasses in 2016. However, there are a number of cattle incidents where the source of infection was most likely to have been wildlife, with mostly badgers (and occasionally deer) implicated.
- g. **Changes in the Epidemic:** The pattern and distribution of new incidents in 2016 suggest a continuing risk of infection coming from the HRA in *Warwickshire and from the Edge Area of North Oxfordshire. It also could be indicative of the emergence of endemic disease in the south west of the *Warwickshire Edge.
- h. **Risks to the LRA and from the HRA.** Remain unchanged from the 2015 year-end report.
- i. **Forward look.** Emphasis on risk-based trading, making herd/holding data available more widely to encourage industry ownership of disease control. Enhancement of wildlife control measures needed.
- h. **Risks to the LRA and from the HRA.** Remain unchanged from the 2015 year-end report, with infection creep from adjacent parts of the HRA, but no explicit risk to the LRA.
- i. **Forward look.** Emphasis on risk-based trading, making herd/holding data available more widely to encourage industry ownership of disease control. Enhancement of wildlife control measures needed.

Appendices

Appendix 1: Edge Area objectives and controls

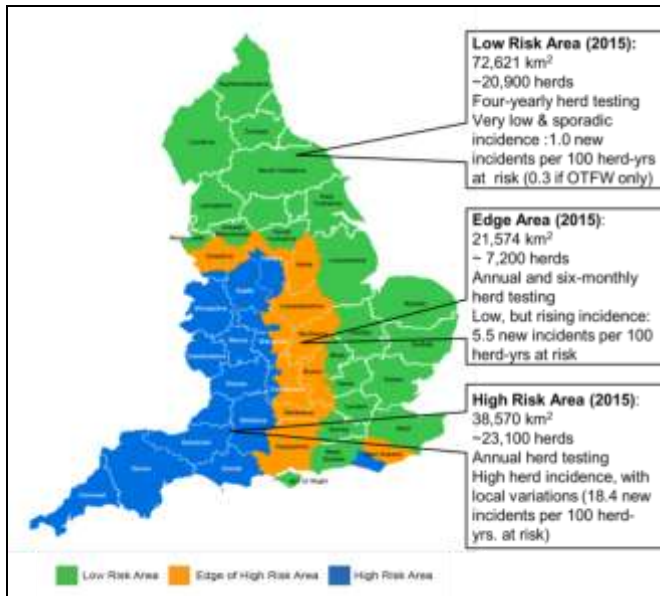


Figure A1: Bovine TB risk and surveillance areas of England (in effect from January 2013, as set out in the strategy for achieving Officially Bovine Tuberculosis Free status for England⁶)

1.1 Policy objectives for the Edge Area:

Short to medium term:

- Slow down geographic spread
- Maintain crude herd incidence of OTFW incidents <2% overall by 2019
- Begin to reduce the incidence rate

Longer term:

- Reduce geographic spread of bTB and push the Edge Area boundaries westward
- Reduce OTFW herd incidence to <1% by 2025

⁶ 'A strategy for achieving Officially Bovine Tuberculosis Free status for England', published at <https://www.gov.uk/government/publications/a-strategy-for-achieving-officially-bovine-tuberculosis-free-status-for-england>

- Attain OTF status (incidence of indigenous OTFW herd incidents <0.1) for the lowest incidence counties in the Edge Area.

1.2 Key Control Measures

Surveillance

- Enhanced herd test coverage (annual)
- Extend targeted surveillance to 3km around new OTFW incidents in *Derbyshire (radial testing), with 6 month follow-up
- 6 monthly whole herd testing in Cheshire from January 2015
- Survey of badgers found dead in the Edge area (starting Spring 2016)

Management of cases ('incidents')

- Increased sensitivity of incident herd testing:
 - OTFS incidents to pass 2 short interval tests at severe interpretation to regain OTF status
 - Mandatory IFN-g parallel testing in OTFW
- Enhanced epidemiological investigation & data analysis

Preventive measures

- Compulsory pre-movement TB testing
- Remove CTS links between HRA and Edge areas
- Approved Finishing Units (AFUs) with grazing not permitted
- Promote risk based trading of cattle
- Badger (Edge) vaccination scheme (currently suspended due to vaccine supply issues)
- bTB biosecurity review project (underway)
- Local bTB awareness events and Eradication Boards
- Information sharing – location of incident herds published

Appendix 2. Epidemiological parameters

County	Number of TB incidents	2014 Incidence	2015 Incidence	2016 Incidence	2016 Prevalence
Berkshire	11	4.5%	5.5%	5.5%	5.2%
Buckinghamshire	13	3.0%	2.7%	2.7%	0.9%
*Cheshire	116	9.3%	9.8%	10.0%	5.4%
*Derbyshire	14	3.9%	7.1%	4.0%	1.0%
Hampshire	44	4.6%	3.1%	4.7%	2.0%
Leicestershire	54	3.8%	4.4%	5.6%	2.0%
Northamptonshire	18	3.2%	3.1%	3.5%	1.1%
Nottinghamshire	23	2.9%	4.0%	5.2%	2.3%
*Oxfordshire	53	8.6%	8.1%	14.6%	7.3%
*East Sussex	11	2.2%	3.7%	2.7%	1.2%
*Warwickshire	24	5.9%	6.9%	6.9%	2.9%

The Animal and Plant Health Agency is an Executive Agency of the Department for Environment, Food and Rural Affairs working to safeguard animal and plant health for the benefit of people, the environment and the economy.

September 2017