

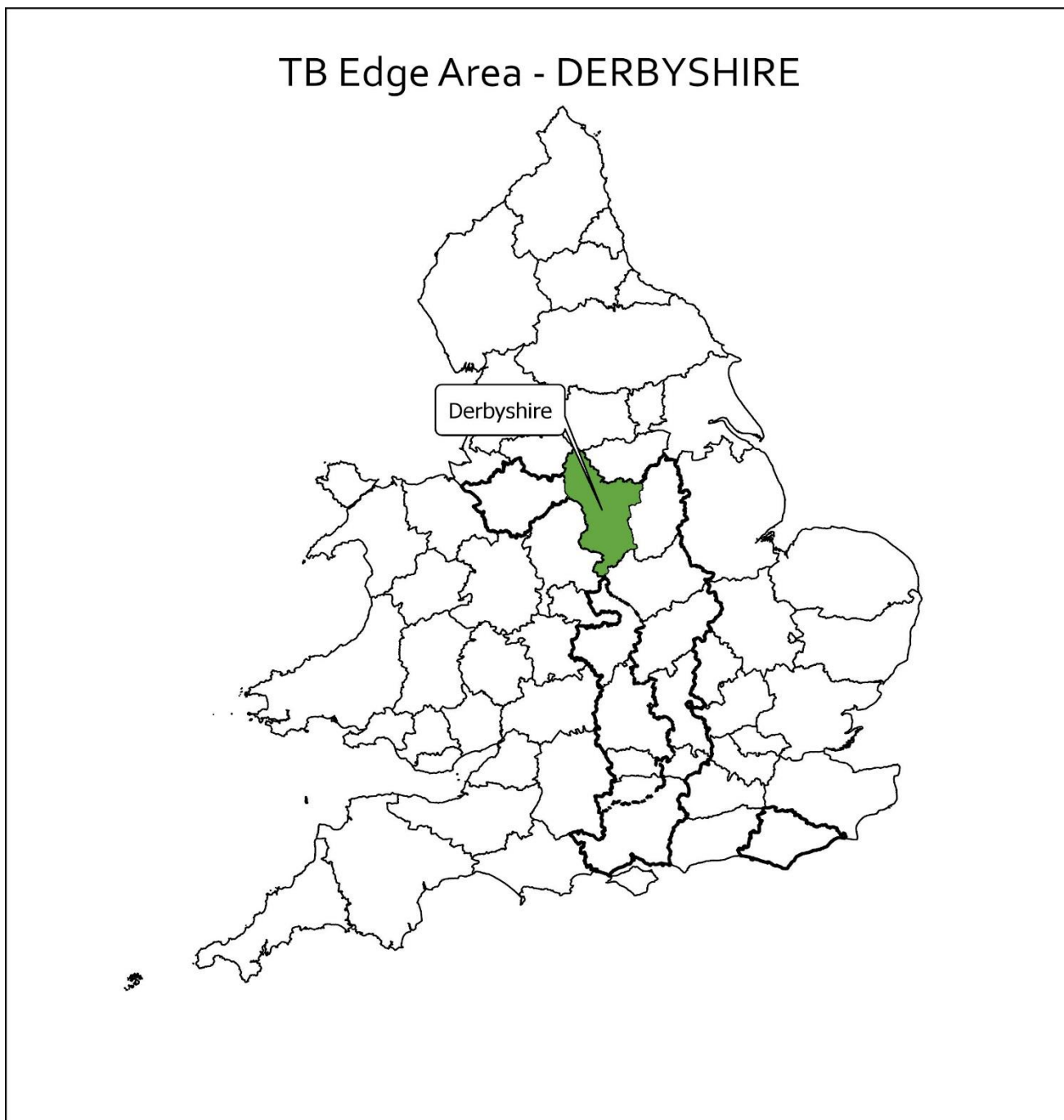


## Year End Descriptive Epidemiology Report: Bovine TB Epidemic in the England Edge Area

**Delivery Area:** Northern

**Name of County:** Derbyshire

**Year-end report for:** 2018



## Contents

Executive Summary .....	3
Introduction .....	4
Changes to the Edge Area in 2018 .....	4
Cattle industry in Derbyshire .....	5
Overview of the bovine TB epidemic in Derbyshire .....	6
History of bovine TB in Derbyshire .....	6
Geographical distribution of bovine TB cases (new and ongoing) in Derbyshire .....	10
Descriptive epidemiology of bovine TB in Derbyshire .....	13
Characteristics of bovine TB in Derbyshire.....	13
Risk pathways for bovine TB infection in Derbyshire.....	16
Role of other species in Derbyshire.....	18
Detection of cases in Derbyshire.....	18
Burden of bovine TB.....	21
Key drivers of the bovine TB epidemic .....	22
County summary .....	23
Summary of risk to the Low Risk Area (LRA) and any mitigating factors .....	23
Summary of the risk to the Edge Area from the HRA.....	23
Summary of the risk to Derbyshire from the adjacent Edge Area counties .....	23
Assessment of effectiveness of controls and forward look.....	24
APPENDICES .....	25
Appendix 1: Overview of risk and surveillance areas of England and Edge Area objectives and controls.....	25
Appendix 2: Cattle industry in the Edge Area of the region .....	27
Appendix 3: Summary of the Derbyshire headline cattle TB statistics.....	28
Appendix 4: Suspected sources of <i>M. bovis</i> infection for all the new OTFW and OTFS breakdowns identified in the report period.....	30
Appendix 5: Overview of the bovine TB Control Programme in Derbyshire .....	31

**Note:** this report was republished in June 2020 with a data correction on p29, Appendix 3, Animal-level statistics table, number of reactors detected, lines 4-7 only.

## Executive Summary

1. The Edge Area has a low but recently rising incidence of infected herds. **Derbyshire** is part of the Edge Area that was established in 2013 as part of the Government's strategy to achieve Officially Bovine Tuberculosis Free (OTF) status for England by 2038. Originally, only the northern and south eastern fringes of the county were included in the Edge Area established in 2013. The rest of the county was part of the High Risk Area (HRA) until 1st January 2018, when the HRA portion of Derbyshire was incorporated into the Edge Area. This end of year report describes the bovine tuberculosis (TB) epidemic in the whole county of Derbyshire in 2018.
2. **Local cattle industry.** A predominantly beef county (fattener and suckler herds), but with a still significant proportion of dairy herds of varying sizes, as well as some calf rearers, smallholders and pet cattle.
3. **New breakdowns of bovine TB.** The number of breakdowns increased from 13 in 2017 to 20 in 2018 in the portion of the county included in the Edge Area since 2013. This increase was seen in both Officially Bovine Tuberculosis Free Status Suspended (OTFS) breakdowns, from 8 in 2017 to 13 in 2018 and in Officially Bovine Tuberculosis Free Status Withdrawn (OTFW) breakdowns, from 5 in 2017 to 7 in 2018.

The number of breakdowns in the whole county of Derbyshire increased from 112 in 2017 to 143 in 2018. This increase was seen in both OTFS breakdowns, from 37 in 2017 to 59 in 2018, and in OTFW breakdowns, from 75 in 2017 to 84 in 2018.

4. **Risk pathways for bovine TB infection.** The most likely infection source for 77% of the new breakdowns in 2018 was wildlife. This is also the most likely source of infection in beef suckler and dairy herds. Movement of cattle from herds with undetected infection was considered responsible for almost 10% of breakdowns, and also the most likely source of infection in beef herds. Recrudescence of a previous infection was the cause of approximately 5% of breakdowns and contact with a contiguous cattle herd for approximately 4%. The remaining 3% was of undetermined origin.
5. **Role of other species.** There were no laboratory confirmed isolations of *M. bovis* in species other than cattle in Derbyshire in 2018. 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 survey of found dead badgers was conducted in 2016-2017 to look for the presence of *M. bovis* in badgers in Edge Area counties. The survey results have not yet been published.
6. **Disclosing tests.** The majority of breakdowns (92% of total; n=132) were disclosed by active on-farm surveillance testing, with 45% (n=59) of these being OTFS.

A total of 45 OTFW breakdowns were disclosed by routine annual surveillance testing (WHT), and 28 were disclosed by enhanced surveillance testing (6 and 12 months post breakdown, tracing and pre-movement skin testing). Slaughterhouse surveillance detected 11 breakdowns.

Thirty nine of the 59 OTFS breakdowns were disclosed by routine annual surveillance testing (WHT), and 20 were disclosed by enhanced surveillance testing (6 and 12 months post breakdown, pre-movement, and radial skin testing).

7. **Impact of bovine TB, reactor numbers.** All the reactors (1,230) were disclosed by active surveillance testing, of which 45% were disclosed by interferon gamma (IFN-g) blood test.
8. **Risks to the Low Risk Area (LRA).** The main risk to the counties of the LRA along the northern border of Derbyshire remains as in previous years in the area adjacent to Greater Manchester, West and South Yorkshire. The most likely infection pathway would be via infected cattle movements. However, the impact of cattle movement into the LRA has been diminished with post-movement TB testing influencing farmer purchasing behaviour.
9. **Risks from the High Risk Area (HRA) and/or other adjacent Edge Area counties.** The risks both to and from Cheshire (Edge Area) are similar for both Cheshire and Derbyshire either via cattle movements or movement of infected wildlife. Longer distance movement of cattle, for further fattening or breeding, via markets within the HRA also poses a risk. There are persistent risks to and from the adjoining parishes in Staffordshire (HRA), as there are no significant geographical barriers preventing cattle or wildlife movements. The risk to the other neighbouring Edge Area counties (Nottinghamshire and Leicestershire) remains as in previous years and is mostly via cattle movements.
10. **Forward look.** The incorporation of the former HRA portion of Derbyshire into the Edge Area in 2018 resulted in greater incidence in that area due to the increased TB testing frequency and identification of likely undisclosed cattle infection in the previous absence of interferon gamma testing. Emphasis on informed purchasing of cattle, making herd/holding data available more widely, is essential to encourage and support industry ownership of TB control. Enhancement of TB control measures in badgers is needed.

## Introduction

A key action in the implementation of the Government's objective to achieve Officially Bovine Tuberculosis Free (OTF) status for England by 2038 was to recognise the different levels of TB in different parts of the country and to vary the approach to control accordingly. To this end three management regions or zones have been established. Overall, the Edge Area has a low but recently rising incidence of infected farms and control efforts are seeking to slow down and reverse geographic spread and reduce the incidence rate, with the aim of obtaining OTF status for this area as soon as possible. This report describes the epidemiology of bovine TB in Derbyshire, which forms part of the Edge Area (see Appendix 1).

## Changes to the Edge Area in 2018

On 1st January 2018 the Edge Area boundary was expanded westwards to absorb fully into the Edge Area the former HRA parts of the five previously split counties of Cheshire, Derbyshire, Warwickshire, Oxfordshire and East Sussex. The reports for those five counties will focus on incidents of bovine TB in the whole county, but noting key differences between the old and new parts where relevant.

From January 2018 annual routine herd surveillance testing was replaced by six monthly herd surveillance testing in the former HRA portion of Derbyshire. The original Edge Area portion continued

to be subject to annual routine herd surveillance testing and targeted testing of herds within a 3km radius of OTFW breakdown herds.

## Cattle industry in Derbyshire

### Herd Types

Beef herds (suckler and fattening) are the predominant herd type in the Derbyshire Edge Area, with beef suckler herds being almost equivalent in number to beef fattening herds. Both fattening and suckler herd sizes can range from very small units comprising fewer than ten animals up to suckler herds with 500 cattle and some fattening herds with over 1000 cattle. Dairy herds are less common, with larger dairy herds tending to be situated towards the west and south of Derbyshire. Most dairy herds are medium to large in size (100–1000 cattle).

There is a predominance of mainly small herds of up to 50 cattle in Derbyshire as shown in Figure 1, and it would be reasonable to assume that the majority of these are beef fatteners or beef sucklers.

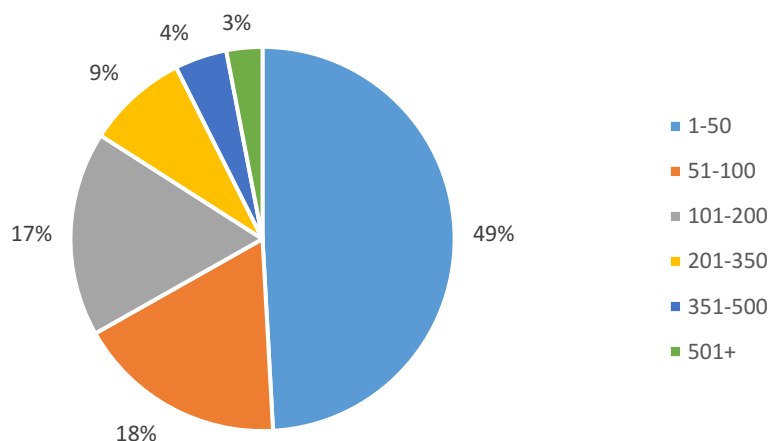


Figure 1: Proportion of cattle holdings by herd size in Derbyshire in 2018 (n=1,557)

### Markets

There is one auction market in Derbyshire: Bakewell market. Other markets utilised by farmers in this area are located in the High Risk Area (HRA): Leek (Staffordshire) and Edge Area: Newark (Nottinghamshire).

These markets facilitate the flow of cattle from the HRA to the Edge Area, potentially providing opportunity for spread of TB from the HRA into the Edge Area. Some of these markets operate Pre-movement Testing Exempt sales and Approved Slaughter Gatherings which are subject to specific TB licensing controls. This is likely to mitigate the risk of spread of TB by cattle moving through these gatherings as only onward movements of cattle directly or indirectly to slaughter are permitted. However, Local Authority (LA) supervision of these gatherings has been reduced in recent years, which increases the risk of spread of TB in the event of breaches in the licensing controls.

### Approved Finishing Units

The number of Approved Finishing Units (AFUs) for TB-restricted cattle in 2018 (11) increased from 2017 (8). All the AFUs in the Edge Area are required to be non-grazing and, if correctly operated according to the strict biocontainment licensing conditions, they are not considered a risk for introduction or spread of TB into the surrounding areas.

### Common Land

There are some small areas of common land in Derbyshire, with low numbers of cattle grazed and no significant co-grazing by more than one herd, so spread of TB related to common land usage is unlikely in this county.

See Appendix 2 for a fuller report on the cattle industry in Derbyshire.

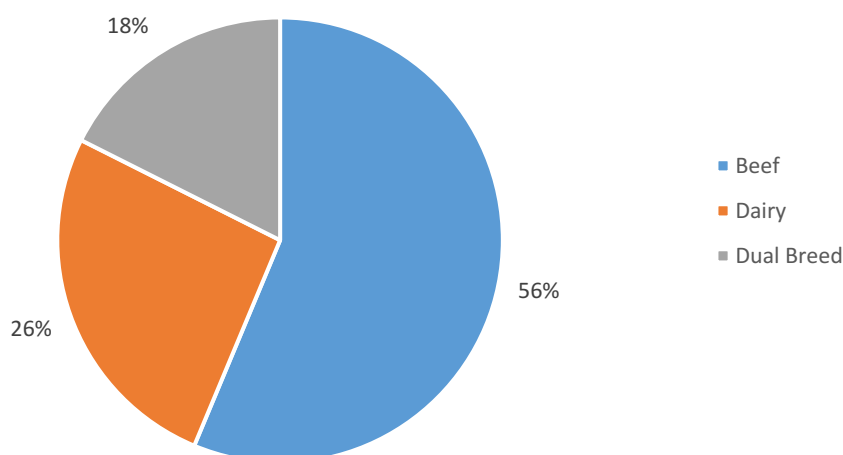


Figure 2: Proportion of cattle holdings by breed purpose in Derbyshire in 2018 (n=2,631)  
(Note: the total number of holdings in Figure 1 varies from the total number of holdings in Figure 2 because holdings are counted more than once when cattle with different breed purposes are present.)

## **Overview of the bovine TB epidemic in Derbyshire**

### ***History of bovine TB in Derbyshire***

Three measures are used to explore the level of bovine TB in this report.

Firstly, the number of new herd breakdowns that were disclosed in each year.

Secondly, the annual herd incidence rate, reported as the number of new incidents per 100 herd-years at risk (100 HYR). This is the number of new TB incidents detected in the year, divided by the time those herds were at risk of contracting TB. The 100 HYR incidence rate is used in this report as it accounts for different intervals between tests in herds that other incidence measures, such as new TB incidents per number of herds or tests, do not<sup>1</sup>.

---

<sup>1</sup>The 100 HYR incidence rate measure is described further in 'Bovine tuberculosis in Great Britain in 2018: Explanatory Supplement to the annual reports' <https://www.gov.uk/government/publications/bovine-tb-epidemiology-and-surveillance-in-great-britain-2018>

Thirdly, the annual end of year herd prevalence. This is the number of herds under restriction due to a TB incident at the end of the reporting year, divided by the number of active herds at that same point in time, and provides a snap shot of the burden of TB on the local cattle industry.

For all three measures, both breakdowns where lesions at post-mortem or *M. bovis* in tissue samples have been identified in one or more animals (officially tuberculosis free status withdrawn, OTFW) and breakdowns where lesions at post-mortem or *M. bovis* in tissue samples have not been identified (officially tuberculosis free status suspended, OTFS) are included. However, TB incidents in AFUs without grazing are not included in the prevalence and incidence calculations in the Edge Area reports due to the limited epidemiological impact of these cases. Furthermore, herds restricted following an overdue test rather than a TB incident are also excluded from calculations.

Over the previous ten years, there has been an increase in the number of infected herds in the original Derbyshire Edge Area as shown in Figure 3a. Prior to 2013, the majority of parishes in the Edge Area counties were subject to two, three, or four yearly testing with, in many cases, exemptions from testing for cattle not used for breeding. The implementation in January 2013 of annual whole herd testing for all cattle herds in the newly-established Edge Area counties, supplemented in the Edge Areas of Derbyshire and Cheshire by targeted (radial) testing around herds with OTFW breakdowns, resulted in an overall increase in testing frequency with few exemptions from testing applicable. This explains in part the rise in the number of new breakdowns from 2013 as more herds were tested per annum than in previous years, with the expectation that more disease would be disclosed as a result. There is an ongoing element of seasonality in the disclosure rate with a general reduction over the summer months, which may be partially explained by a reduced testing rate at this time of year.

The number of breakdowns in the original Edge Area portion of Derbyshire reached a peak of 26 in 2015, but has almost halved in 2016 (14), 2017 (13), increasing in 2018 (20).

The source of a significant number of cases in the 2015 spike has been attributed to badgers, and this is thought to be directly linked to major works undertaken on the main Sheffield to Manchester railway line during 2014 and 2015. Circumstantial evidence suggests that there may have been perturbation of the badger population located near to the line, which may have changed the usual pattern of contact between badgers and cattle in the locality.

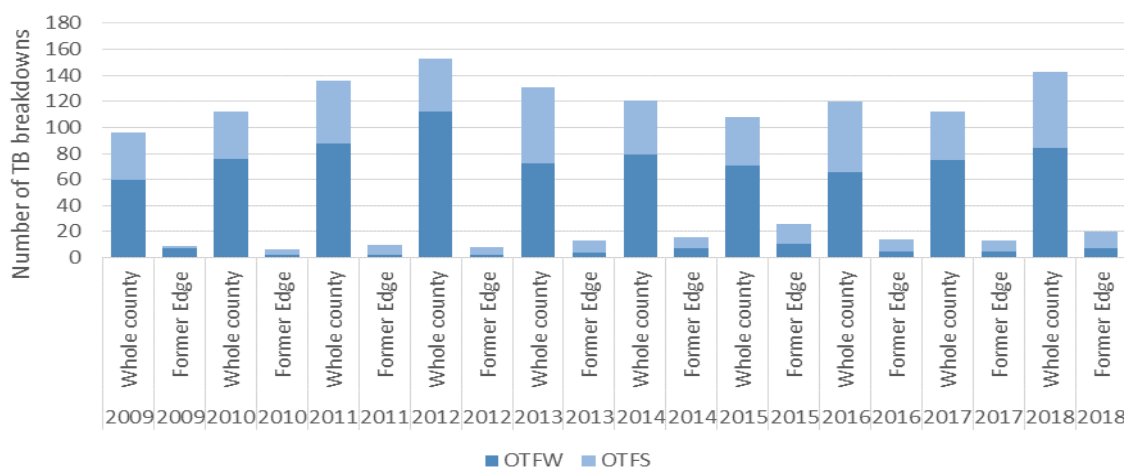


Figure 3a: Annual number of new TB breakdowns in the original Edge Area section and in the whole of Derbyshire, 2009-2018

In the newly expanded Edge Area (i.e. the whole Derbyshire county), there have been fluctuations in the number of infected herds over the previous ten years, as shown in Figure 3b. In the whole county, the number of breakdowns increased sharply from 2009 to 2012, and then decreased and stabilised between 2013 and 2017. However, in 2018, the number of breakdowns showed another sharp increase, which could have been linked to the overall increase in the sensitivity of the surveillance testing regime following the application of Edge Area policies to the previous HRA area of Derbyshire. The overall increase in testing frequency (from every twelve to every six months) in the former HRA portion of the county since January 2018 could partially explain the rise in the number of new breakdowns as more herds were tested per annum than in previous years, with the expectation that more disease would be disclosed as a result.

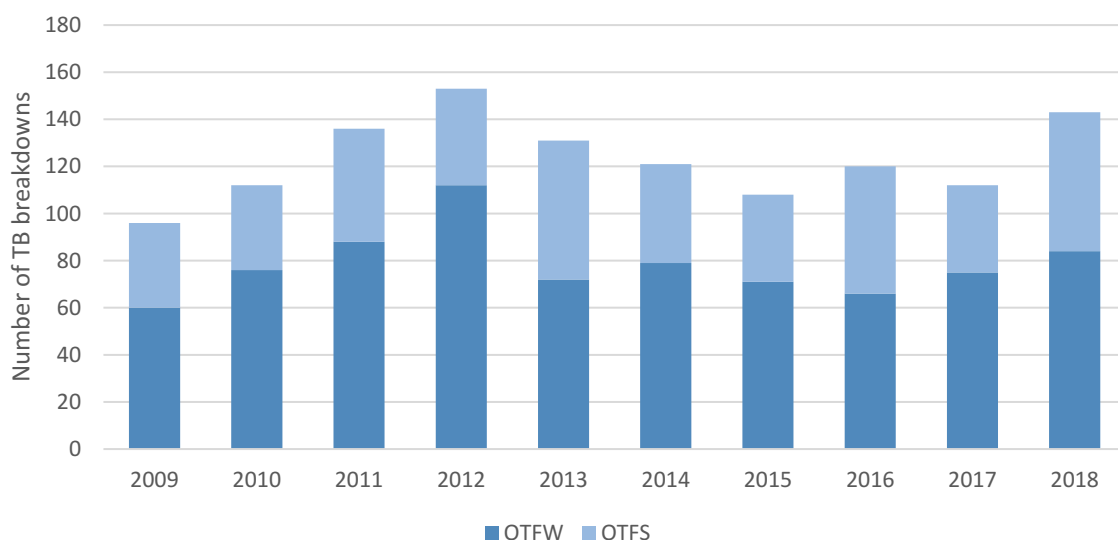


Figure 3b: Annual number of new TB breakdowns in Derbyshire (whole county) 2009-2018

The TB incidence rate in Derbyshire was calculated for 2009-2018, and this is shown in Figures 4a and 4b below. The annual herd incidence rate for the whole county increased by 0.7% compared to 2016 and 2017. This can be partly explained by the increased herd testing frequency in the former HRA section of Derbyshire, where herds are tested at six monthly intervals now instead of annually, with increased testing frequency leading to earlier disclosure of disease in herds. Also, as the 2018 summer was especially arid increasing wildlife activity rooting for food may have increased the cattle-wildlife interaction. All this could have resulted in an increase in incidence compared to the previous years although there could be other factors to consider.



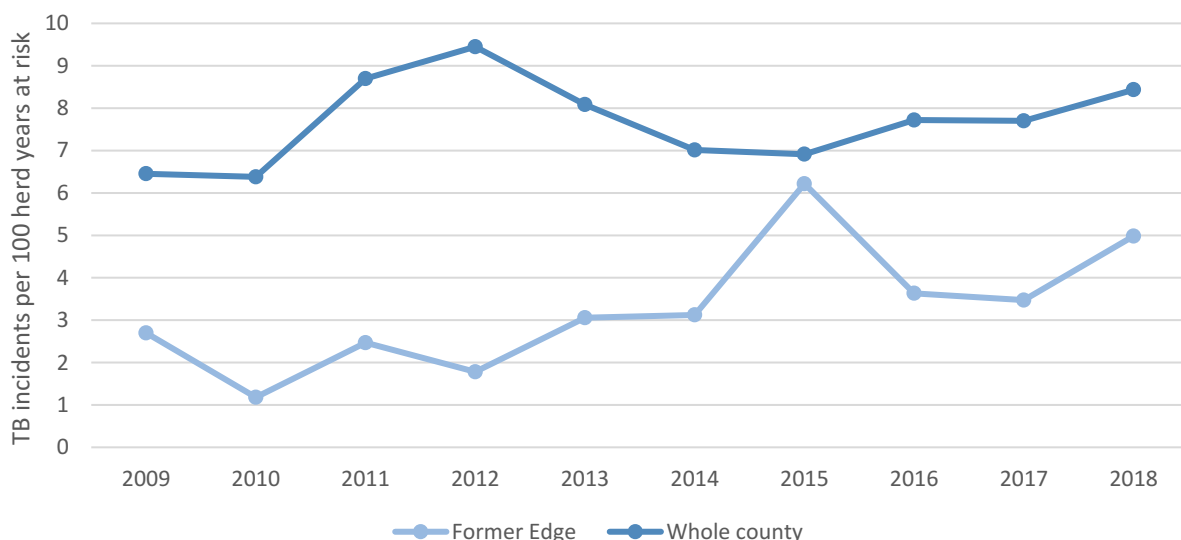


Figure 4a: Annual herd incidence rate (per 100 herd-years at risk) for all new breakdowns (OTFW and OTFS) in the original Edge Area section and in the whole of Derbyshire (2009-2018).

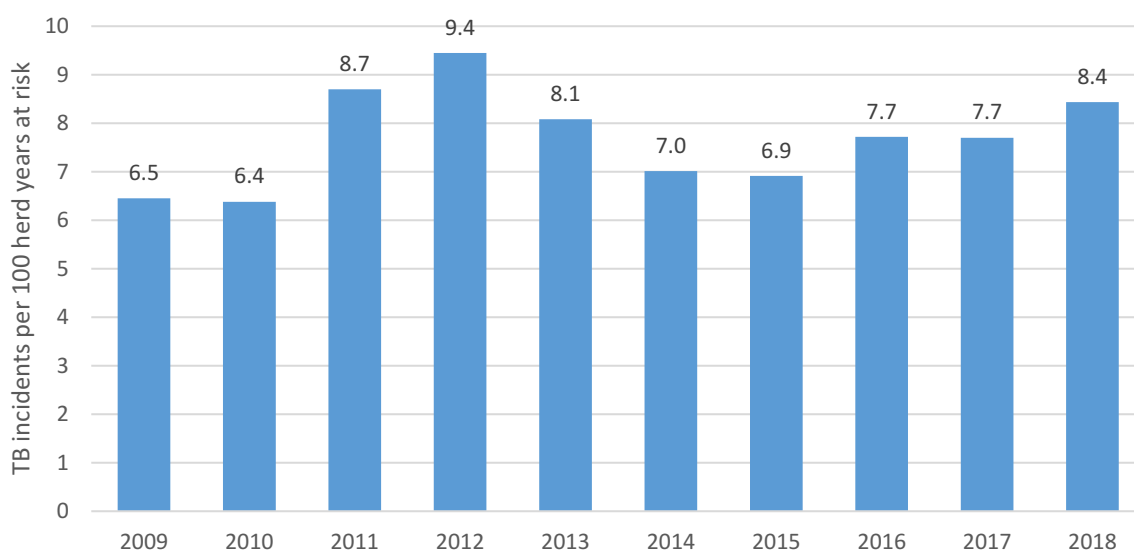


Figure 4b: Annual incidence rate (per 100 herd-years at risk) for all new breakdowns (OTFW and OTFS) in Derbyshire (whole county), 2009-2018.

The prevalence measure takes into account new and existing incidents at a point in time (end of 2018) and this shows an increase of 1.74% from 2017 (Figure 5a). Also, in tests where skin or interferon gamma reactors are identified, the next Short Interval Test (SIT) is now scheduled to take place no sooner than 60 days after effective removal of all the test reactors from the farm, unlike in previous years when the SIT date was scheduled to occur 60 days from effective isolation of reactors from the rest of the herd. This could increase the duration of TB restrictions compared to previous years.

At the end of 2018, almost 6% of all cattle herds in Derbyshire were under TB restrictions. However, as illustrated in Figure 5b, prevalence in the original Edge Area portion has decreased slightly by 0.16% from 2017. This indicates that the increasing prevalence in the whole county is being driven by prevalence increases in the former HRA portion of Derbyshire.

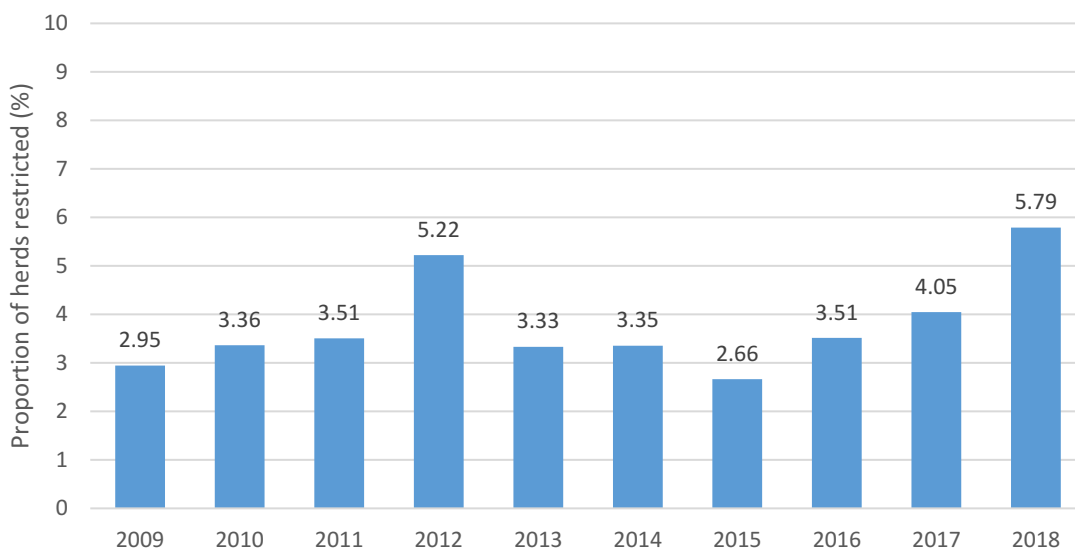


Figure 5a: Annual end of year prevalence of restricted herds in Derbyshire, 2009-2018.

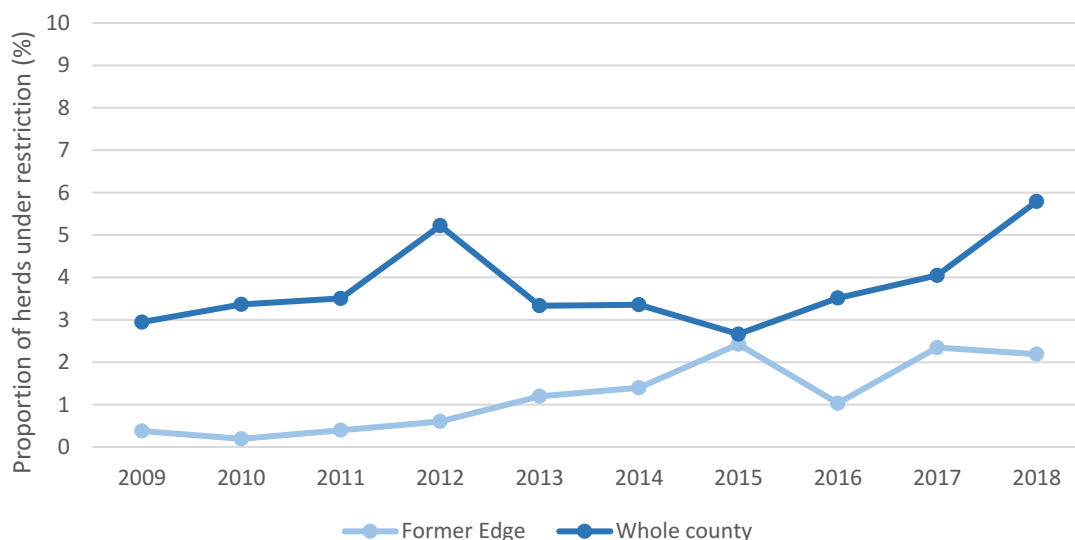


Figure 5b: Annual end of year prevalence of restricted herds in the former Edge and whole county of Derbyshire, 2009-2018.

In summary, the above figures illustrate that Derbyshire is unlikely to be eligible for OTF status by 2025 as set out by the criteria for the Edge Area in the bovine TB Strategy published in 2014.

### **Geographical distribution of bovine TB cases (new and ongoing) in Derbyshire**

Figure 6 below shows the geographical distribution of all existing and new TB incidents in 2018 and, for OTFW breakdowns, the associated spoligotype. The map also shows the cattle herd density (animal density in the inset map) and the extent of the former HRA portion of the county, in which the majority of breakdown herds lay.

The distribution and density of incidents appears to be mainly in the south-west of the county mirroring the highest density of cattle holdings and cattle. However, there was an extension towards central Derbyshire in 2018. Many of the incidents in the west appear to have been carried over from 2017.

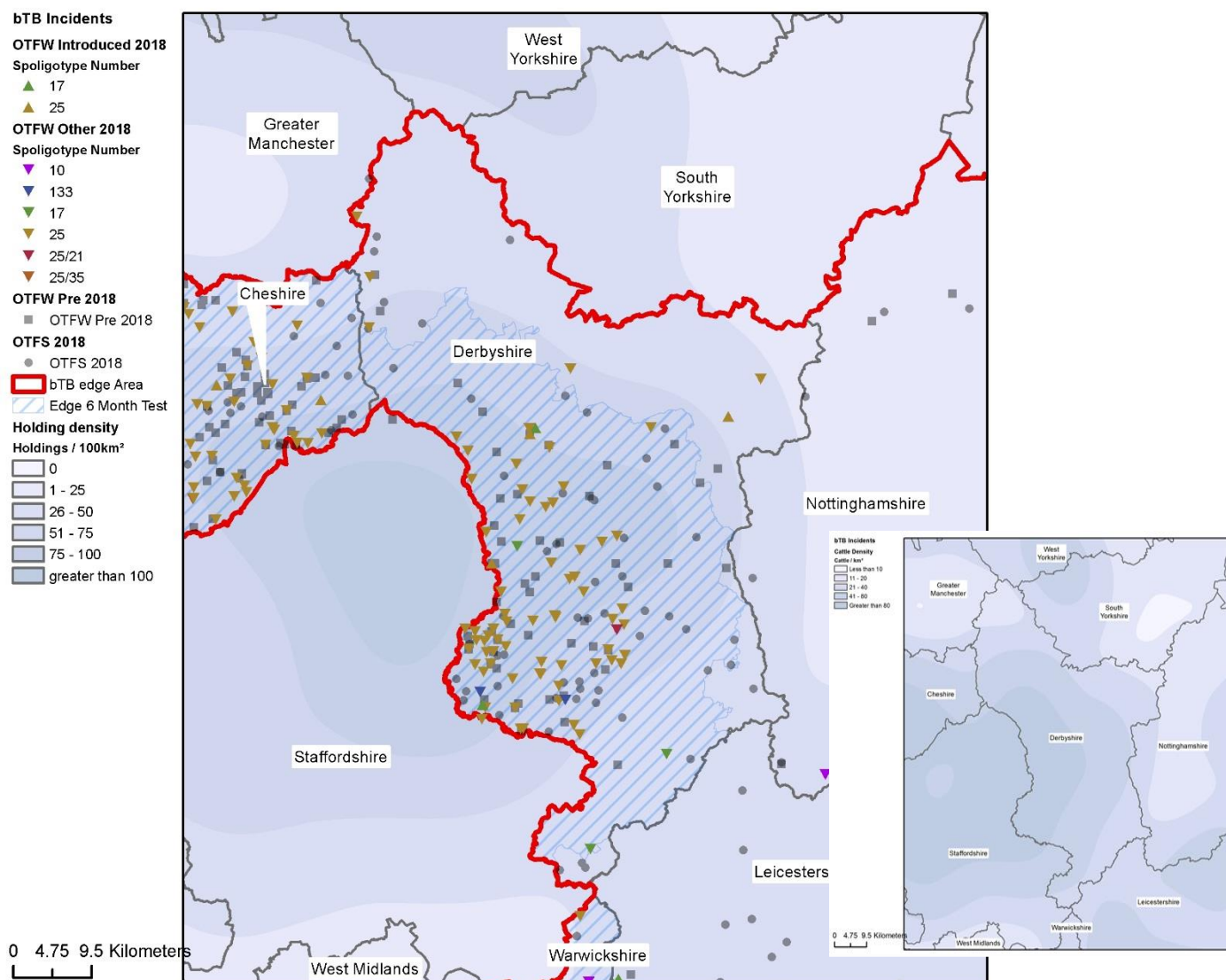


Figure 6: Geographical distribution of all new TB breakdowns (OTFW and OTFS) in 2018 and pre 2018 OTFW breakdowns still ongoing at the end of the report period, overlaid on a cattle holding density map, with a cattle density map for the area inset.

Figure 7 shows the incidents most probably associated with a wildlife source, from information gathered during farm visits. Looking at farm activity and lack of cattle movements reveal a clustering of incidents to the west and south of Derbyshire, which correspond with the areas of highest cattle densities. There is strong epidemiological evidence that there are endemically infected badger populations in Derbyshire, especially within the former HRA section towards the west of the county around the border with Staffordshire (HRA). Genotypes 25:a and 25:b are endemic in parts of Derbyshire, as can be observed from the map below (same colour circles indicating matching genotypes, clustered in space and time). Further epidemiological studies, with the assistance of whole genome sequencing (WGS) of *M. bovis* isolates, will greatly increase our knowledge and support devising future policy measures.

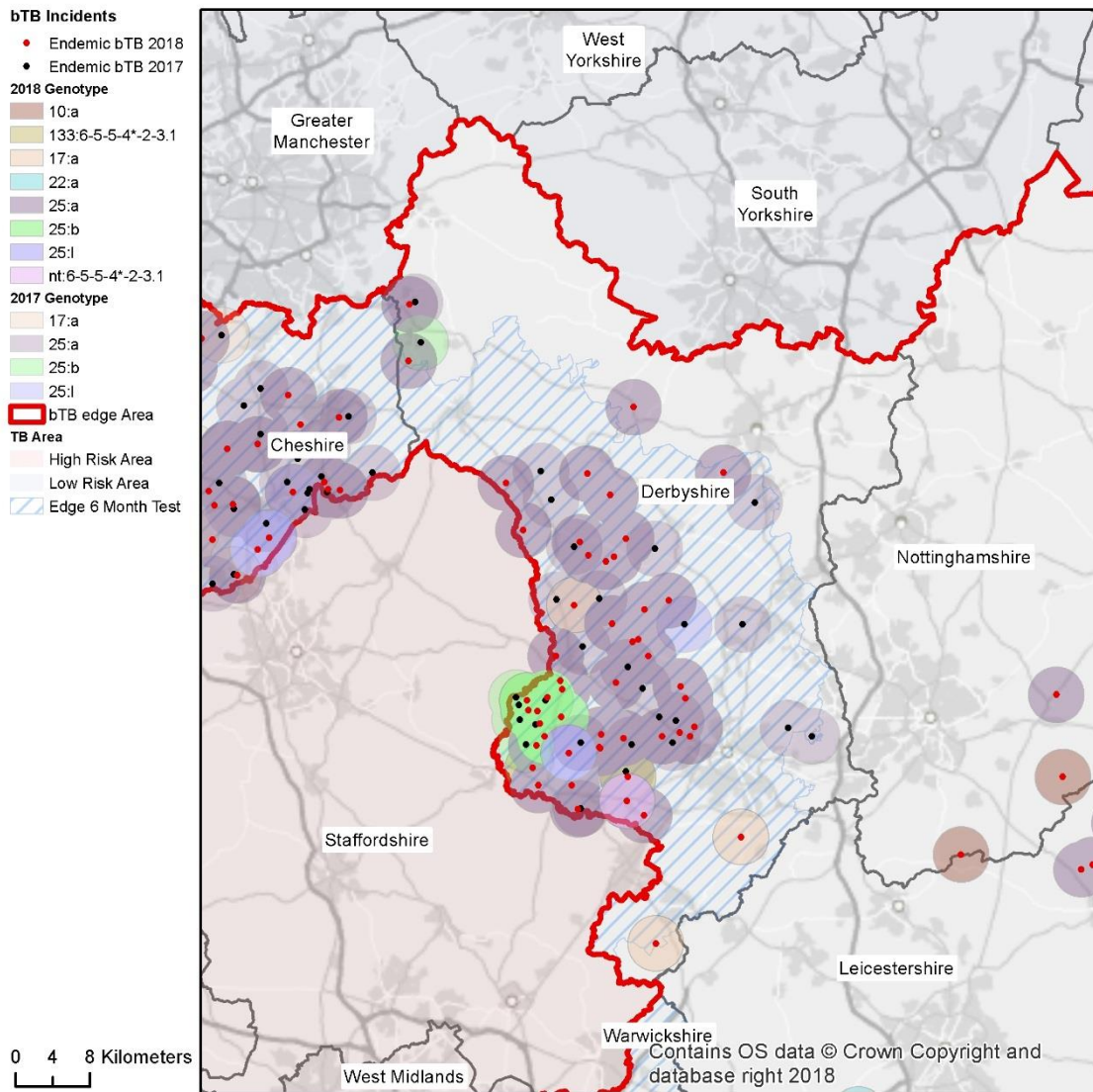


Figure 7: Genotypes detected in Derbyshire, where a wildlife source was attributed with a 75% certainty or above, as an indication of endemicity within local wildlife populations (OTFW breakdowns only).

As shown in Figure 8, there appears to be an abundance of incidents attributed primarily to wildlife (green), especially in the south-west Derbyshire area. There are considerably fewer attributed to the movement of infected cattle (red), which are more sporadic in nature as would be expected, and a few attributed to local cattle-to-cattle spread (blue) via nose-to-nose cattle contact or straying from neighbouring cattle herds. Some are undetermined sources (grey) and this may be due to the fact that the breakdown is not yet resolved or no single source could be attributed.



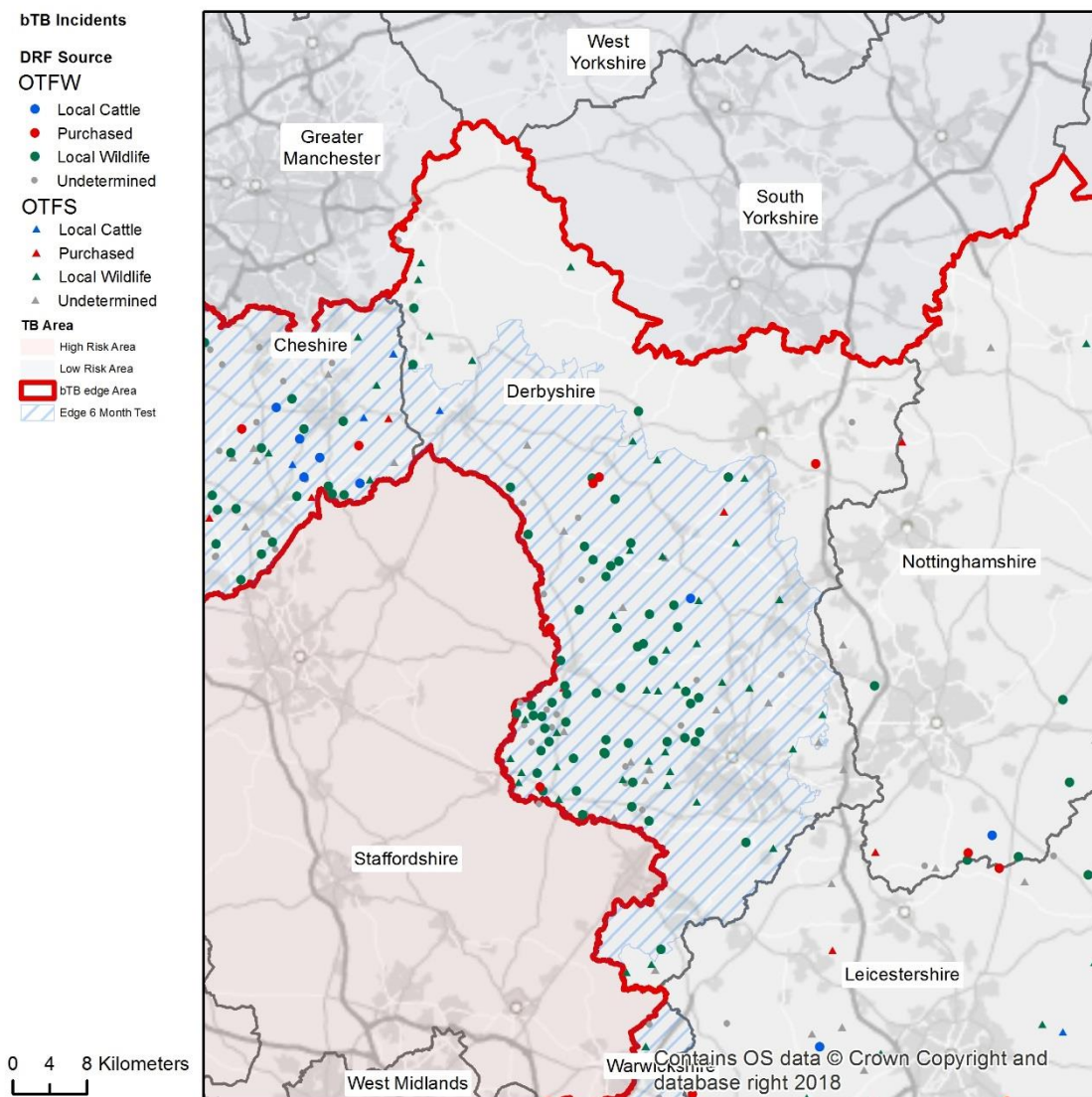


Figure 8: The source of infection recorded with the highest level of certainty, for all TB breakdowns (OTFW and OTFS) that started in 2018

## Descriptive epidemiology of bovine TB in Derbyshire

### *Characteristics of bovine TB in Derbyshire*

The new breakdowns in 2018 were differentiated by herd size and herd type as shown in Figure 9.

Dairy herds accounted for 46% (66) of breakdowns with more than half of those being classed as OTFW. Within the beef suckler herd category, which accounted for 23% (33) of the total breakdowns, of which around two thirds were OTFW. This is in contrast to the beef fatterer herds, which accounted for 29% (42) of the total breakdowns but with less than half of those being OTFW. The other/mixed herd category accounted for almost 2% (2) of the total breakdowns and both of those were OTFW. The general distribution of breakdowns partly reflects the distribution of cattle herd types in Derbyshire, where beef herds (suckler and fattening) predominate.

As shown in Figure 9, the largest number of breakdowns (35) occurred in the 201-350 herd size group, this group accounting for 9% of all herds. This is in comparison to 49% of Derbyshire herds having 1-50 cattle present with only 20 breakdowns in this sector. Looking at the proportion of affected herds by size category a clear trend evidences that the risk of infection increases proportionally to the size of

the herd [1-50 is 3% (20/761), 50-100 is 8% (23/274), 100-200 is 12% (32/267), 200-350 is 27% (35/132), 350-500 is 22% (15/68) and 500+ is 38% (18/47)].

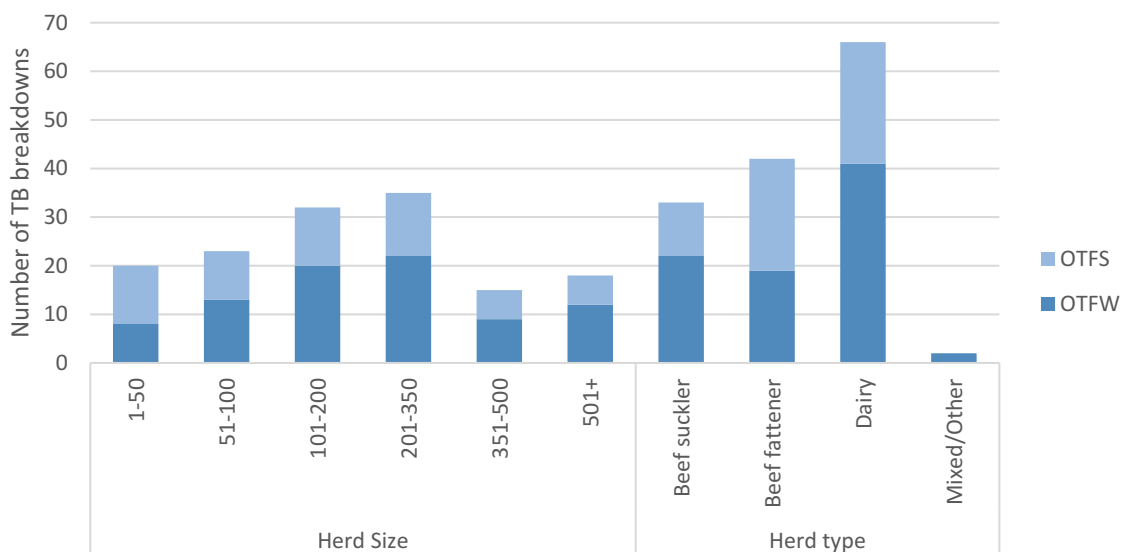


Figure 9: Number of new TB breakdowns (OTFW and OTFS) in Derbyshire, by cattle herd size and type.

Figure 10 shows the epidemic curve for 2018 with breakdowns differentiated into OTFS and OTFW status and month of disclosure. The graph shows a peak of 18 breakdowns disclosed in January and a further 54 breakdowns disclosed between September and December 2018, which is likely due to the increase in TB testing carried out when herds are tested at the end of the grazing season. There were lower levels of disclosure during the summer (grazing) months apart from August when 17 new breakdowns were detected. The summer of 2018 was especially arid and grass growth was slow. Complementary feeding at pasture may have given rise increased cattle-badger interaction.

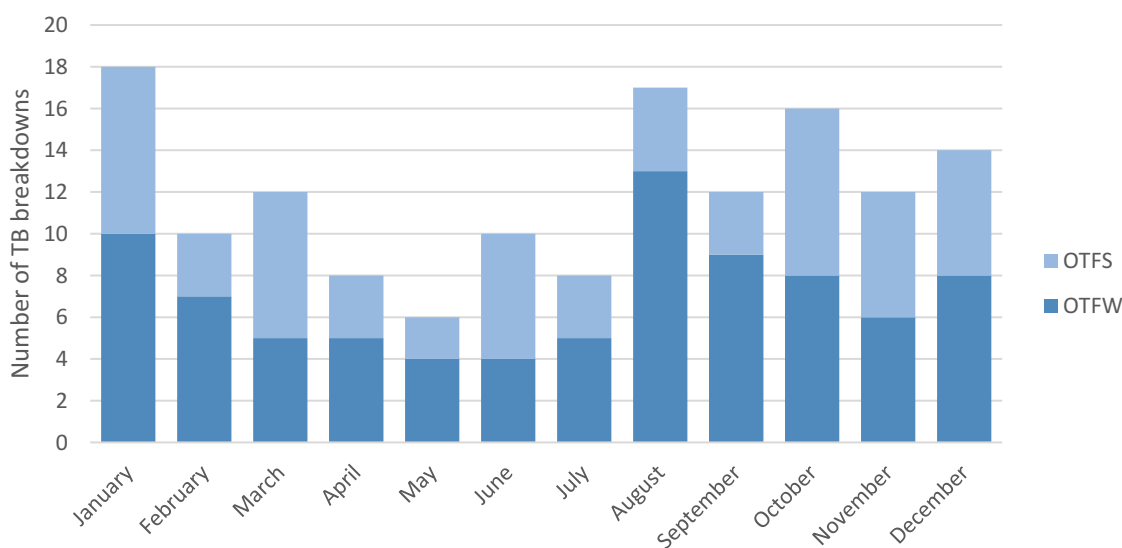


Figure 10: Number of new TB breakdowns (OTFW and OTFS) in Derbyshire, by month of disclosure.

As shown in Figure 11 there were 61 occurrences of genotype 25:a out of 84 OTFW breakdowns disclosed in 2018; there were 9 occurrences of 25:b genotype and 5 occurrences of 17:a genotype of *M. bovis*. Genotype 25:a is endemic in parts of Derbyshire, consistent with data from 2017. Nevertheless, it must be noted that only one genotype is isolated from each new incident (extra genotyping is only done on request from case veterinarians in exceptional circumstances) therefore these figures do not consider concurrent infections with more than one genotype.

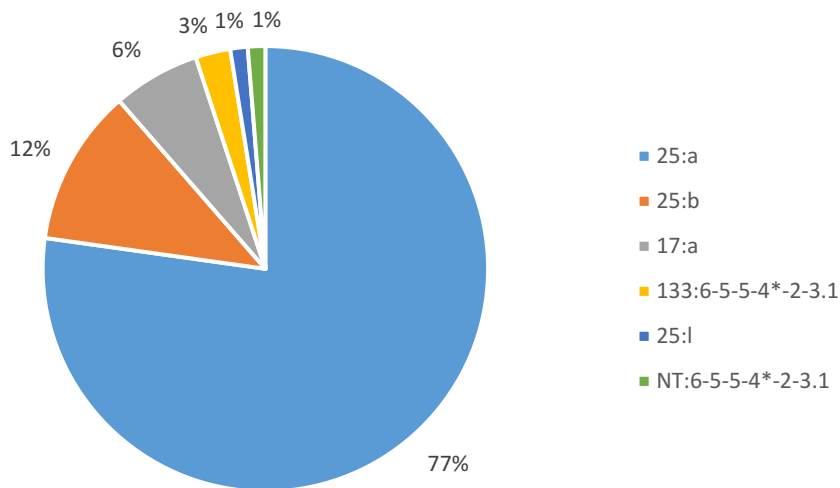


Figure 11: Genotypes of *M. bovis* (OTFW only) identified in Derbyshire in 2018 (n=79).

Figure 12 shows the distribution of breakdowns by duration in 2018. For the 69 OTFW breakdowns closed during 2018, the mean duration was 268 days and for the 48 OTFS breakdowns it was 187 days. Of the OTFW breakdowns the median length of breakdown was 236 days. The duration has increased slightly from previous years.

Three persistent breakdowns (those with a duration over 18 months/551 days) out of four active were closed during 2018 - one of them had been ongoing since 2014.

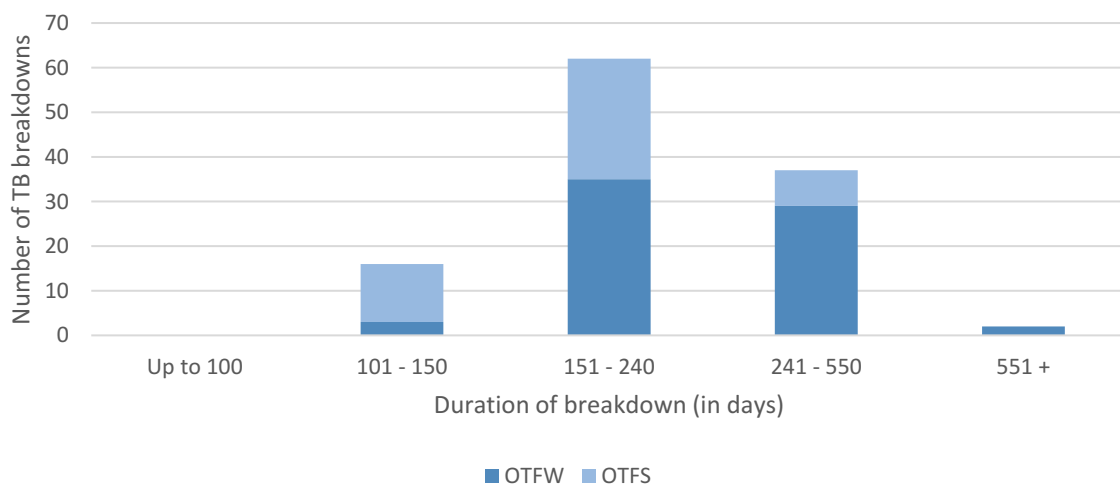


Figure 12: Duration of TB breakdowns (OTFW and OTFS) closed in Derbyshire in 2018.

## ***Risk pathways for bovine TB infection in Derbyshire***

Establishing the route of entry of infection into a herd experiencing a new TB incident can be challenging. The Animal and Plant Health Agency (APHA) aims to complete an epidemiological assessment of all TB incidents in the Edge Area (both OTFW and OTFS), including a thorough on-farm investigation. However where resource constraints exist, as many new incidents as possible are randomly selected or triaged for an investigation visit. Scrutiny of routinely collected data such as cattle movements and *M. bovis* genotypes (available for OTFW incidents only), combined with data from the on-farm investigation and knowledge of the local area epidemiological situation provides information which enables APHA case vets to assess and then rank the possible disease pathways.

A mathematical algorithm based on risk pathway data was used for the 2018 period to determine the relative contribution of different sources for each breakdown herd. However, this methodology also included those incidents where certainty about risk pathways was lower because of gaps in the epidemiological evidence. The effect of uncertainty has been increased by the inclusion of OTFS herds, where by definition, no genotype was determined. Therefore the relative proportions of each risk pathway are very approximate, and broad generalisations only can be made from these data.

A more detailed description of this methodology is provided in the Explanatory Supplement<sup>1</sup>.

As shown in Figure 13, approximately 77% of all new herd incidents in Derbyshire in 2018 were attributed to infected badgers, with almost 10% attributed to movements of infected cattle, either originating locally or purchased from further afield. Approximately 6% were attributed to residual infection in the herd, usually due to the new incident occurring at the 6M post-breakdown herd test with an identical genotype isolated.

Only 4% of new herd incidents were attributed to contiguous cattle contact where neighbouring cattle groups may have had nose-to-nose contact. This appears to be much less of a risk lately, as farmers are more aware of keeping other cattle away due to the risks of contracting other diseases as well as TB. Many will not graze cattle in adjoining fields and prefer to have an arable buffer area in between or may use paddock rotation to avoid cattle being in contiguous fields at the same time.

The high percentage of new herd incidents attributed to badgers in Derbyshire could be due to the fact that most of those incidents occur within the previous HRA of the county where the epidemiology of the disease resembles that of the endemic (HRA) areas of the country. There is also the possibility that, given that three quarters of the genotypes detected are 25:a and this has an extremely large geographical distribution, some cases where disease spread is classified as local could actually have been brought by cattle moved within the home range of this genotype therefore obscuring the effect of cattle movements in the development of the epidemic.

Occasionally it is impossible to differentiate between several possible sources such as residual infection, infected wildlife, or cattle purchase as all three may be suspected and these are often classed as unknown source breakdowns.



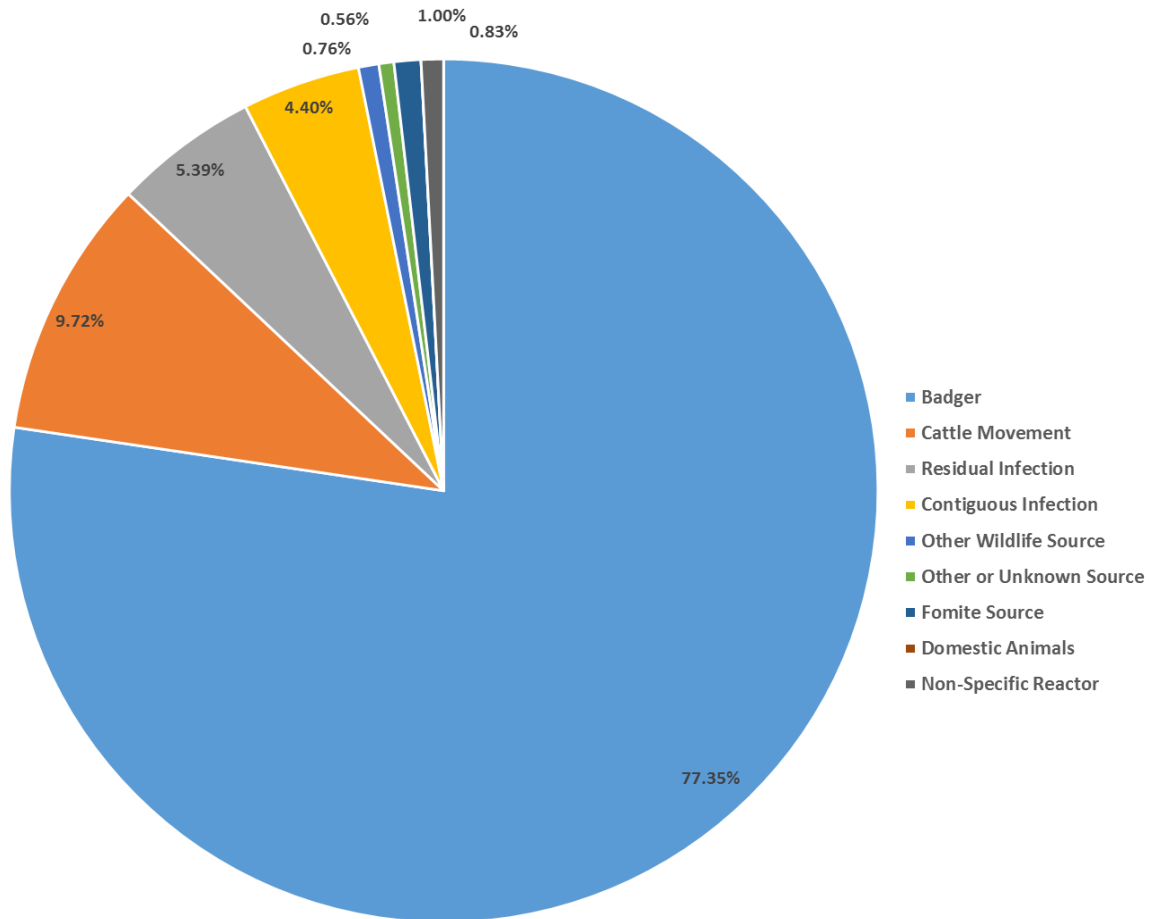


Figure 13: Summary of the weighted source of infection attributed for all incidents (both OTFW and OTFS) in Derbyshire that started in 2018.

As shown in Figure 14, in beef fattener herds (excluding non-grazing AFUs), wildlife (badgers and deer) was the most commonly attributed infection source (77%) as these holdings may graze or may have floor-feeding troughs or feed barriers which can be accessed by badgers or other wildlife. Contact with other local cattle and cattle movements account for 23% of all incidents which is to be expected as most of these will be in herds which purchase replacement stock.

In beef suckler herds, wildlife source of infection was attributed in almost 90% of all incidents with 11% attributed to contact with other local cattle and cattle movements. Again this appears consistent with the husbandry of these herds where there will be fewer purchases and cattle will be grazed.

In dairy herds, 96% of all incidents were attributed to wildlife and only 4% attributed to cattle movements and other sources. Again showing consistency with dairy husbandry and common practice of minimal or no purchase in many Derbyshire dairy herds and paddock grazing where grass is intensively utilised but may lead to increased indirect contact with badgers at pasture or via fresh cut grass if the cattle are housed.

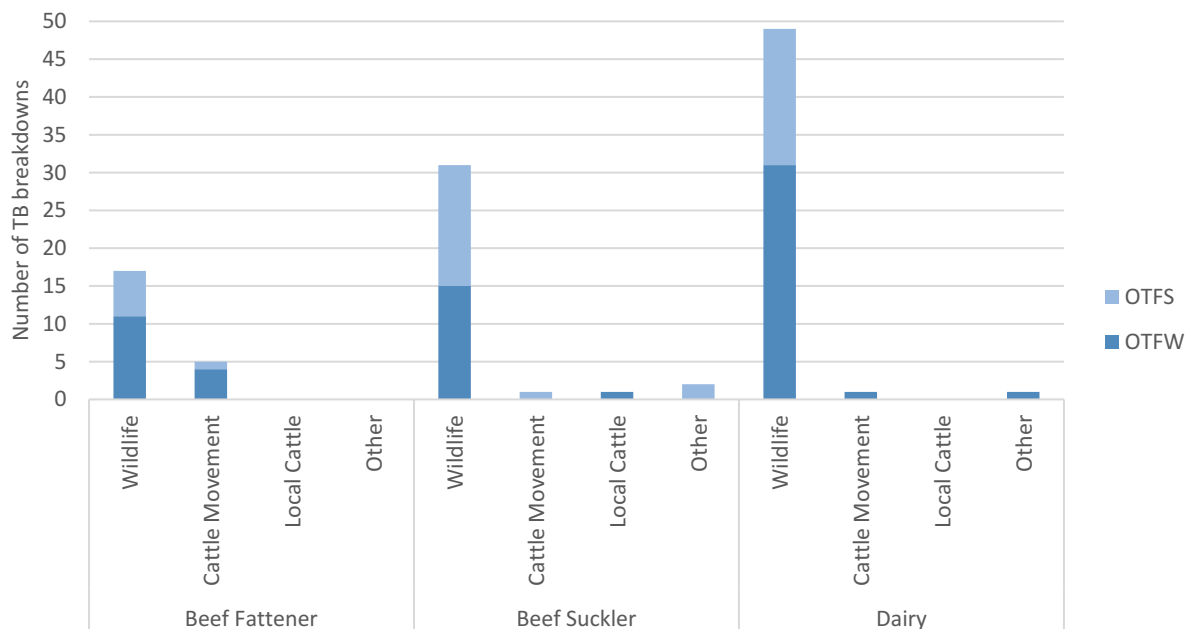


Figure 14: Source of infection recorded with the highest level of certainty for all TB breakdowns (both OTFW and OTFS) in Derbyshire, by herd type.

## ***Role of other species in Derbyshire***

### ***Badgers and other wildlife***

APHA laboratories have not confirmed any isolations of *M. bovis* in wild animals such as badgers or wild deer carcasses in this area in 2017 and 2018.

Derbyshire has a high density badger population as evidenced by the number of road kills observed and from gathering information at the Disease Report Form (DRF) visit. The majority of farmers report observations of badger activity on farm and on surrounding land. APHA field vets rely on information provided by the farmer and on inspection of the premises at the Disease Report Visit (DRF). Many APHA field staff have also attended training in badger ecology which has proved very valuable in promoting biosecurity measures on farm and when conducting the disease investigation. As shown in Figures 7 and 8, many of the incidents in 2018 were attributed to infected badgers, which is consistent with observations in other endemic areas of the country. Since the great majority of breakdowns in Derbyshire have occurred in the previous HRA, it is to be expected that the determination of disease risk pathways resembles that of the HRA rather than that expected in other counties in the Edge.

### ***Other domestic species***

There were no reported cases of TB infection in other domestic animal species in Derbyshire in 2018.

## ***Detection of cases in Derbyshire***

Routine surveillance testing comprises six monthly whole herd testing (WHT) for all farms in the newly established portion of the Derbyshire Edge Area (former Derbyshire HRA) and twelve monthly whole herd testing in the original Edge Area. Routine six monthly testing of all cattle herds (except AFUs) in the former HRA portion of the county has removed the need for contiguous testing (CON) around

OTFW herds in that area. Additional targeted surveillance testing (radial testing) is carried out in the original Edge Area. Non-routine testing includes post-breakdown testing (6M) tests, tracing tests (TR), pre-movement tests (PRMT) and check tests (CT). The more frequent testing will detect infection earlier allowing less time for disease to spread within the herd and reduce the spread out of the herd.

Passive surveillance at abattoirs is carried out by the Food Standards Agency (FSA) by post mortem examination of all cattle slaughtered for human consumption. Slaughterhouse cases (SLH) are animals in which lesions suspicious of TB have been disclosed at the abattoir.

Figure 15a below shows that almost 60% of new incidents (84) in 2018 were disclosed at routine herd surveillance testing with the whole herd annual or six-monthly test (WHT). The second most common method of incident disclosure was the herd check test carried out six months after a breakdown has ended (6M), amounting to 11% of new incidents (16). This may reflect that either disease was not completely removed from the herd by the breakdown testing programme and/or an outside source of infection persists within the farm environment. More incidents were disclosed in 2018 using this test type than in 2017 most probably due to the incorporation of the former HRA of Derbyshire into the Edge Area. The third most common reason for disclosure was pre-movement testing of individual animals (8%) and 12-month post breakdown check testing (12M) (8%).

Passive surveillance (routine post-mortem meat inspection of non-reactor cattle) at slaughterhouses disclosed 11 breakdowns (8% of the total).

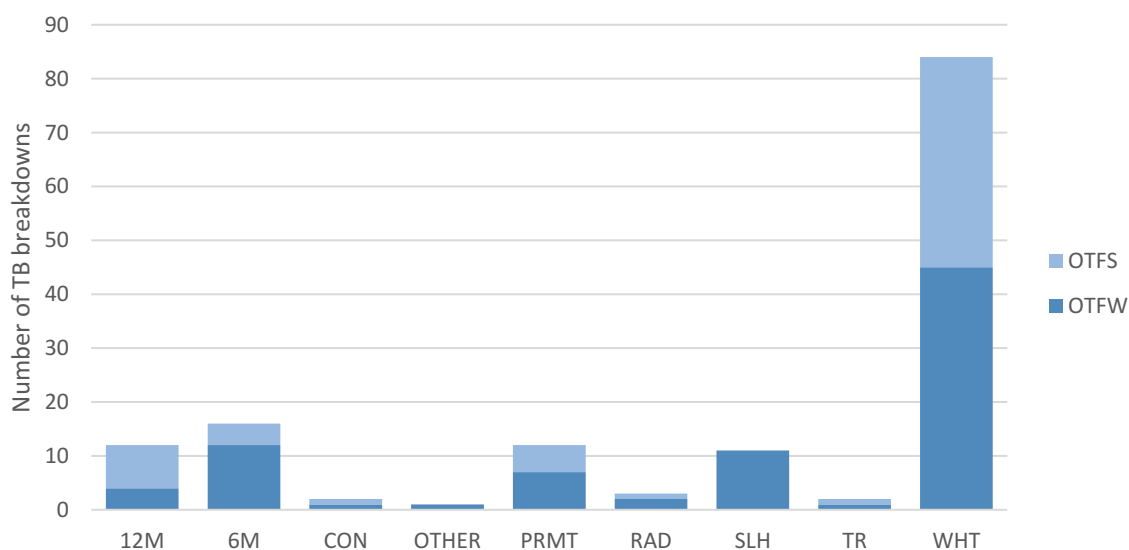


Figure 15a: Number of TB breakdowns (OTFW and OTFS) in Derbyshire in 2018, disclosed by different surveillance methods (surveillance method types are further described in the Explanatory Supplement<sup>1</sup>).

Figure 15b shows that there was an increase in the number of new incidents disclosed as a result of post-breakdown TB testing (6M) and a slight decrease due to routine surveillance testing. Contiguous testing was replaced in 2014 by radial testing (RAD) in the original Derbyshire Edge portion. Contiguous testing continued in the former HRA portion until its incorporation into the Edge Area in 2018, at which point contiguous testing ceased and was replaced by the six monthly WHT. Six monthly herd testing has been well received by Derbyshire farmers as it provides more confidence that disease in cattle is being identified earlier than it would have been when a longer interval between TB tests was in place.

Trace testing appears to have resulted in fewer new incidents, possibly due to an awareness of risk based trading by farmers. The detection of cases by passive surveillance in slaughterhouses appears relatively consistent with previous years.

The increased frequency of testing has several advantages such as earlier identification of disease in a herd, less spread of infection within and between herds leading to lower numbers of reactors, less environmental contamination due to decreased numbers of reactors, and less risk of transmission to wildlife. In conclusion this appears to be an effective method of applying cattle controls in the long term.

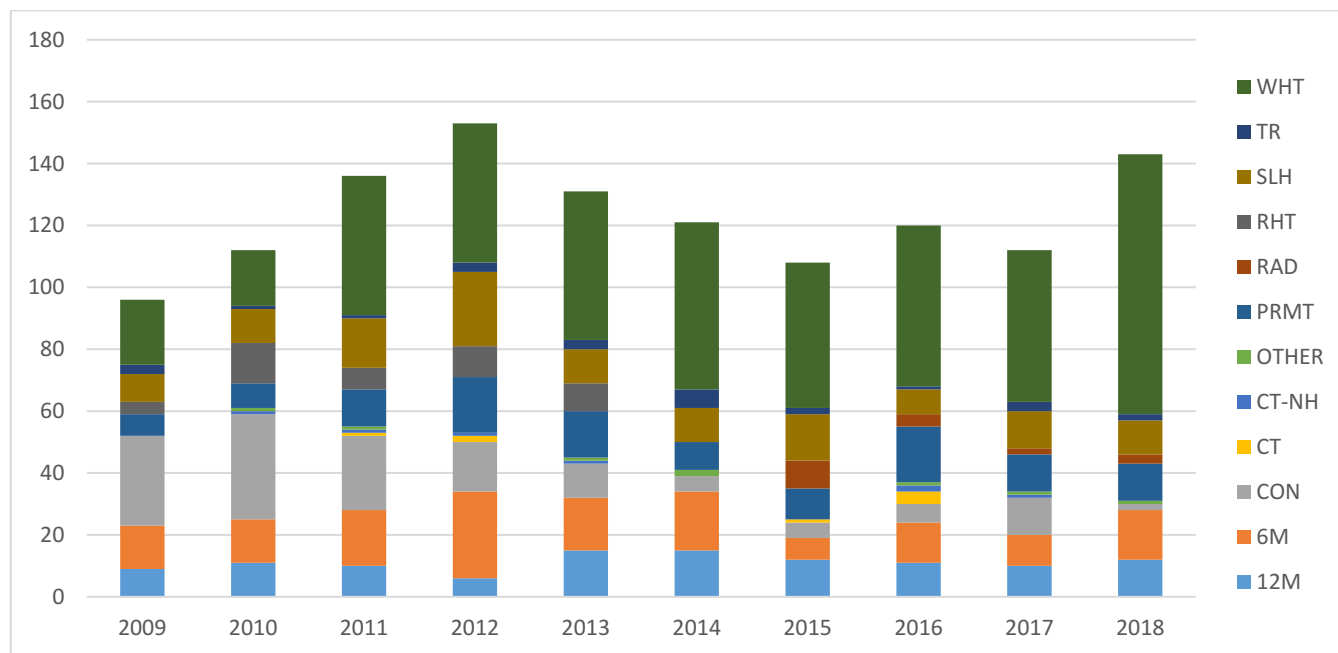


Figure 15b: The method of disclosure of new incidents in Derbyshire from 2009-2018 (surveillance method types are further described in the Explanatory Supplement<sup>1</sup>).

Taking into consideration that 1,376 herds in Derbyshire were classed as Officially TB Free (OTF) in 2018 with no previous history of TB, 85 of these herds (6%) had a new incident of TB in 2018.

As shown in Figure 16, recurrence appears to be relatively common in Derbyshire. Of the breakdowns which were new in 2018, almost 40% (54) had a history of infection in the previous 3 years. There was little difference between OTFW 40% (33 out of 81) and OTFS 36% (21 out of 58) breakdowns.

The reasons for recurrence can be variable depending on herd activity and distribution within Derbyshire. As with any diagnostic tool, the TB skin test used alone could miss a small proportion of truly infected animals (false negatives). Even when applied in series (repeatedly) and/or in combination with the interferon gamma test this possibility decreases markedly but in some cases will not be totally eliminated. The proportion of true positives missed could greatly increase if the TB skin test is not applied exactly according to the standard operating procedure. Monitoring and auditing by APHA and the TB skin testing Delivery Partners ensure that the performance of the TB skin test adheres to high standards of quality. Infected cattle or contamination of feed or environment can lead to re-infection within a herd and further spread. It is acknowledged that in areas of high incidence of TB, badgers play a major role in maintaining TB in cattle herds through environmental contamination. When a herd regains OTF status, cattle purchases may be made which may also increase risk of bringing TB into

the herd or there may be cattle movements between holdings under the same ownership within large enterprises.

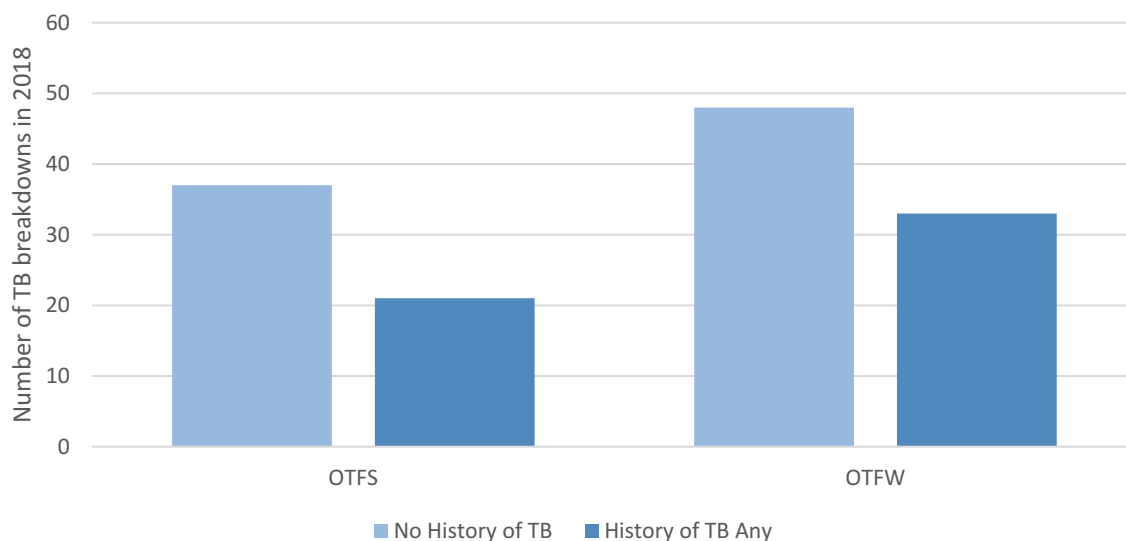


Figure 16: Number of TB breakdowns (OTFW and OTFS) in Derbyshire which experienced a breakdown in the previous 3 years.

### ***Burden of bovine TB***

The burden of TB in Derbyshire is considerable in terms of the number of breakdowns at any one time, the number of cattle being slaughtered, the economic effects on both the farming business, associated agricultural businesses, and the impact on the taxpayer. TB impacts on the ability to move cattle off the breakdown premises which can have considerable consequences for breeding stock, for weaned beef calves, stores and for dairy calves not normally reared on farm. Likewise, stock to replace reactors which have been slaughtered can prove difficult to acquire in the case of pedigree or organic herds. In herds where large numbers of reactors are disclosed no stock is allowed to move on before the first breakdown test and then only following completion of a veterinary risk assessment and implementation of stringent mitigation measures. The economic losses to dairy farms in the case of lost milk yield can be significant and can be further impacted by financial penalties imposed by the dairies through breaches of contract and not meeting forecasted milk yields.

Some of the larger dairy farms in the county operate over several geographically discrete sites. TB breakdowns can make management of these herds complex, particularly where separate heifer rearing premises are used, many of which are not equipped to deal with calving or milking cattle.

In winter, housing capacity may be limited and there are risks of overstocking and potential welfare issues. Many farmers do not have the capacity to erect additional housing so it is important for them to consider contingency plans in the event of a TB breakdown and to minimise the impact on cattle welfare and economic losses.

For beef herds that rely on selling stores rather than finishing, TB can have a significant economic effect resulting in cash flow problems and possibly overstocking. The existence of AFUs and TB Isolation Units can lessen the impact although full market prices are rarely available for TB restricted cattle.

Figure 17 shows the proportion of skin and interferon gamma reactors detected in 2018 compared to previous years. The rise in numbers is most probably due to the fact that the Derbyshire HRA has been incorporated into the Derbyshire Edge and has resulted in the increased use of compulsory interferon gamma testing in OTFW incidents. The interferon gamma test has a higher sensitivity than the skin test and so will disclose more infected cattle, often at an earlier stage or those which may have been missed by the skin test.

A total of 1,230 cattle were slaughtered from Derbyshire incidents in 2018 as skin or interferon gamma reactors. Of these, 45% (557 cattle) were interferon gamma reactors and 55% (673 cattle) were skin test reactors. This is in contrast to 2017 where, in the whole county, 672 cattle were slaughtered as skin or interferon gamma reactors. Only 7% were interferon gamma reactors and 93% were skin reactors. An explanation for this change, as well as the incorporation of the former Derbyshire HRA into the Edge and therefore the generally increased application of interferon gamma testing, is that large numbers of gamma positive cattle have been disclosed in some of the new incidents located in the former HRA portion of the county.

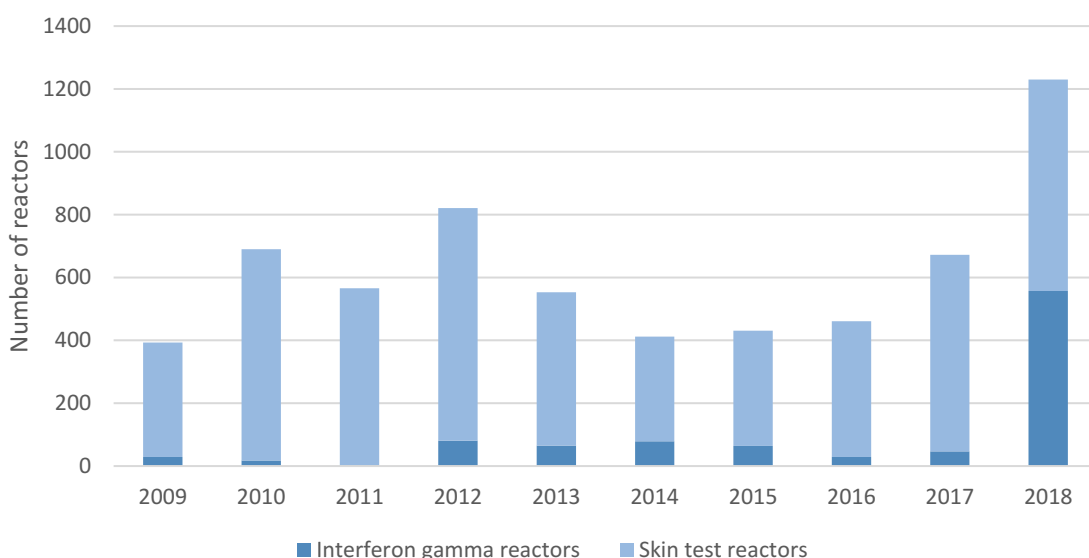


Figure 17: Number of reactors detected by interferon gamma and skin tests in Derbyshire, 2009 to 2018

### **Key drivers of the bovine TB epidemic**

Key drivers of the epidemic in Derbyshire include continued spreading infection in badgers acting as a reservoir for disease in cattle, but may also include undisclosed infection in cattle in the former HRA portion of the county where interferon gamma testing of OTFW breakdown herds was not mandatory until 2018. The continued use of interferon gamma testing in combination with skin testing will maximise the chances of detecting cattle infection.

Infected badgers represent the disease risk pathway most commonly attributed in new incidents as described previously. The analysis of the available data from 2018 TB breakdowns indicates that infected badgers play a role in the maintenance of TB in Derbyshire and it is important to continue to reduce the amount of TB infection in both cattle and badgers in order to make effective progress in future.

Although a few larger dairy herds source their replacements from TB-free areas of the UK or Europe, the use of markets in the nearby HRA appears to still pose a risk of disease dissemination to Derbyshire. There is some incipient recognition and awareness of the need for informed purchasing of cattle but this is a message that still needs to be embraced by the wider farming community.

Earned recognition status is being implemented in 2019 where some herds in Derbyshire will automatically revert to annual herd testing instead of six monthly herd testing. Anecdotally many farmers are opposed to this because they want earlier disclosure of disease and have acclimatised themselves to the more frequent herd testing.

The Farm Level TB reports produced by APHA have also proven useful and of interest to farmers. However, these are only issued during a TB breakdown.

### **County summary**

Derbyshire is unlikely to achieve OTF status in the short term and certainly not by 2025 due to the incidence reported in 2018 and in preceding years, especially when the available data suggest that disease is endemic in both cattle and wildlife populations in large parts of the county. However, increased cattle and badger control measures plus the incorporation of the former HRA of Derbyshire into the Edge Area will be very beneficial and essential in order to decrease the environmental burden. Informed purchasing of fattening and breeding replacements will also reduce the risk of importing disease from the HRA or more endemic parts of the Edge Area. In addition, increased biosecurity both on and off farm through education and implementation will support these control measures and provide the best possible chance of success in reducing the overall incidence of TB and the burden to the tax payer in the long term.

### **Summary of risk to the Low Risk Area (LRA) and any mitigating factors**

North Derbyshire continues to pose a potential risk via cattle movements to the LRA county of South Yorkshire in particular which has a high cattle density with many large dairy herds. However, the lack of suitable badger habitat, combined with enhanced surveillance testing of cattle (radial testing) around fully confirmed (OTFW) incidents in this part of Derbyshire provide some mitigation against wildlife spread.

The occurrence of wildlife-linked breakdowns during previous years in areas close to the LRA of Greater Manchester appears to have declined during 2018. However, the potential of this corridor to act as a disease transmission route from endemic areas towards the LRA cannot be underestimated.

### **Summary of the risk to the Edge Area from the HRA**

The summary of risks to Derbyshire is unchanged from 2017, namely the risk of an advancing endemic front of infection from the HRA county of Staffordshire.

### **Summary of the risk to Derbyshire from the adjacent Edge Area counties**

Figures 7 and 8 above show that there were new incidents disclosed as a result of likely wildlife infection on both sides of the Cheshire–Derbyshire border so there appears to be an equal risk from either side in this area either via cattle movements or infected wildlife movements.

The level of disease pressure from Nottinghamshire and Leicestershire, both Edge Area counties, appears to be very low, with very low levels of disease around these areas of both counties.

## Assessment of effectiveness of controls and forward look

The incorporation of the former Derbyshire HRA into the Edge Area in 2018 has resulted in a higher incidence in that area due to the increased TB testing frequency, which also highlights that the increase in sensitivity of the tests applied is being successful in identifying and removing infected cattle more efficiently. However, there is indirect epidemiological evidence of infected wildlife in this area and so control of infection in both cattle and badger populations is required to achieve a healthier population of both.

In cattle, the mandatory use of interferon gamma testing to support the skin testing in herds sustaining OTFW breakdowns will ensure that as much undisclosed cattle infection is removed as soon as possible. The application of appropriate badger control measures will complement these enhanced measures and enable removal of as much infection as possible. The Badger Edge Vaccination Scheme (BEVS) has been ongoing in areas of Derbyshire and may support the buffering of areas of low disease incidence from pockets of endemicity. It is unlikely that an immediate effect will be observed for any of these measures and it is more likely that it will take a further two or three years before benefits become evident.

Biosecurity awareness is increasing amongst the farming community through different routes such as communications with APHA case vets, the farmers' own veterinary providers, the implementation of the Defra-funded TB Advisory Service<sup>2</sup>, and access to the TB Hub website<sup>3</sup>. Farmers' understanding of different aspects of the ecology of the disease is improving as a result and this is helping them to recognise and implement appropriate biosecurity measures. The awareness of the importance of informed cattle purchasing is also increasing aided by the availability and use of the interactive TB mapping tool (ibTB)<sup>4</sup>.

---

<sup>2</sup> TB advisory service - <http://www.tbas.org.uk/>

<sup>3</sup> TB hub website - <https://tbhub.co.uk/>

<sup>4</sup>ibTB interactive mapping tool - <https://ibtb.co.uk/>



## APPENDICES

### Appendix 1: Overview of risk and surveillance areas of England and Edge Area objectives and controls

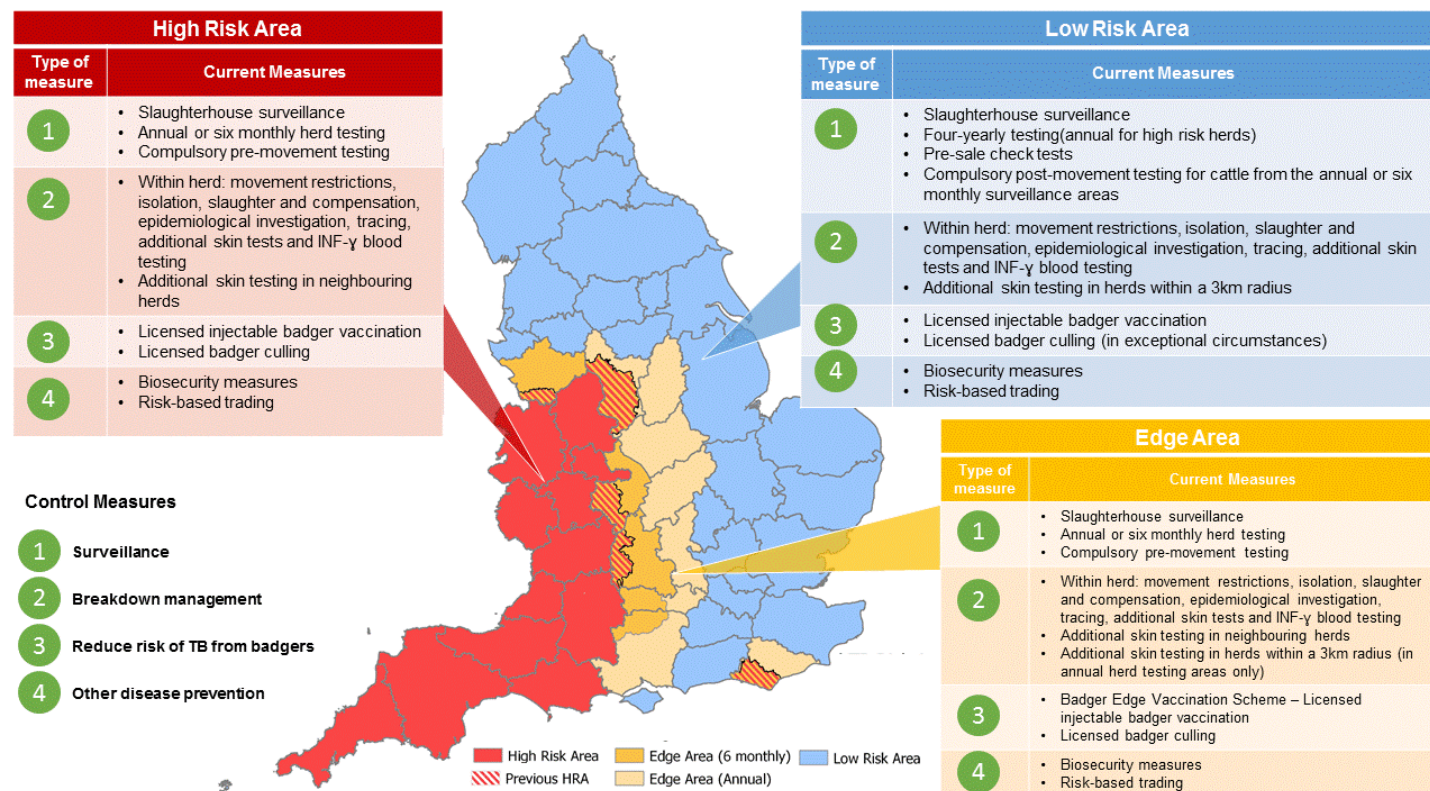


Figure A1: Bovine TB risk and surveillance areas of England effective since January 2018, as set out in the Government's Strategy for Achieving Officially Tuberculosis-Free Status for England<sup>5</sup>.

#### 1.1 Policy objectives for the Edge Area:

Short to medium term:

- slow down geographic spread
- maintain crude herd incidence of OTFW breakdowns <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
- attain OTF status (crude incidence of indigenous OTFW herd breakdowns <0.1%) for the lowest incidence counties in the Edge Area.

#### 1.2 Key Control Measures

Surveillance:

- six monthly or annual routine herd testing

<sup>5</sup> <http://www.tbhub.co.uk/wp-content/uploads/2017/09/infographic-TB-measures.pdf>

- additional targeted surveillance of cattle herds located within a 3km radius of new OTFW breakdowns in annual testing sections of the Edge Area (radial testing)
- slaughterhouse surveillance

#### Management of cases ('breakdowns'):

- increased sensitivity of breakdown herd testing:
  - all breakdown herds must pass two consecutive short interval skin tests at severe interpretation to regain OTF status, irrespective of post-mortem and bacteriological findings
  - mandatory IFN-gamma parallel testing of herds with OTFW breakdowns
  - enhanced management of herds with persistent breakdowns
- enhanced epidemiological investigation and data analysis
- information sharing - location of breakdown herds publicly available (via ibTB interactive mapping tool)<sup>6</sup>

#### TB controls in the wildlife reservoir (badgers):

- licensed badger culling in high incidence sections of the Edge Area
- Government grants for licensed voluntary badger vaccination projects using injectable badger BCG (Badger Edge Vaccination Scheme - BEVS)

#### Other measures:

- compulsory pre-movement skin testing of cattle moved between herds
- promotion of herd biosecurity measures to reduce the risk of new breakdowns

---

<sup>6</sup> ibTB interactive mapping tool - <https://ibtb.co.uk/>

## Appendix 2: Cattle industry in the Edge Area of the region

Number of cattle premises by size band in the Edge Area of the region at 1 January 2018

(RADAR data)

Cattle per premises	1-50	51-100	101-200	201-350	351-500	501+	All	Mean	Median
Number of premises	761	274	267	132	68	47	1557	109.0116	53

Finishing units registered in Derbyshire:

	Grazing	Non-grazing
Number of Approved Finishing Units (AFUs)	0	10
Number of Pre-movement Testing Exempt Finishing Units (EFUs)	2	3

There is some common land in the Derbyshire Edge Area, but of low significance because of the small land parcel sizes.

Cattle/herd purpose:

	Beef		Dairy		Dual purpose		Unknown		Total
	Number	%	Number	%	Number	%	Number	%	Number
Cattle	90745	53.5	71909	42.4	7073	4.2	4	0.0	169731
Holdings	1479		686		462		4		

**Appendix 3: Summary of the Derbyshire headline cattle TB statistics**

<b>Herd-level statistics</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Total number of cattle herds live on Sam at the end of the reporting period	1828	1785	1736
Total number of herd tests carried out in the period	1933	1830	2448
Total number of OTF cattle herds TB tested during the period for any reason	1546	1484	1487
Total number of OTF cattle herds at the end of the report period (i.e. herds not under any type of TB02 restrictions)	1728	1683	1564
Total number of cattle herds that were not under restrictions due to an ongoing TB breakdown at the end of the report period.	1762	1712	1636
Total number of new TB breakdowns detected in cattle herds during the report period	120	112	143
OTF status suspended (OTFS)	54	37	59
OTF status withdrawn (OTFW)	66	75	84
Of the OTFW herd breakdowns:			
How many can be considered the result of movement, purchase or contact from/with an existing breakdown based on current evidence? *(Data for 2016 and 2017 refers to the former Edge only).	1*	4*	20
New OTFW breakdowns triggered by skin test reactors or 2xLRs at routine herd tests. *(Data for 2016 and 2017 refers to the former Edge only)	2*	0*	49
New OTFW breakdowns triggered by skin test reactors or 2xLRs at other TB test types (forward and back-tracings, contiguous, check tests, etc.) *(Data for 2016 and 2017 refers to the former Edge only)	3*	1*	5
New OTFW breakdowns first detected through routine slaughterhouse TB surveillance	8	12	11
Number of new breakdowns revealed by enhanced TB surveillance (radial testing) conducted around those OTFW herds (may not be applicable to every county in the Edge Area)			
OTFS *(Data for 2016 and 2017 refers to the former Edge only)	3*	2*	1
OTFW *(Data for 2016 and 2017 refers to the former Edge only)	1*	0*	2
Number of OTFW herds still open at the end of the period (including any ongoing OTFW breakdowns that began in a previous quarter)	41	52	67
New confirmed (positive <i>M. bovis</i> culture) incidents in non-bovine species detected during the report period (indicate host species involved)	0	0	0

<b>Animal-level statistics (cattle)</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Total number of cattle tested in the period (animal tests)	254341	250263	345786
<b>Reactors detected:</b>			
tuberculin skin test	432	625	673
additional IFN-gamma blood test reactors (skin-test negative or IR animals)	29	47	557
Reactors per breakdown	3.8	6.0	8.6
Reactors per 1000 animal tests	1.8	2.7	3.6
Additional animals identified for slaughter for TB control reasons (DCs, including any first-time IRs)	34	11	33
Private slaughters	1	2	15
SLH cases (tuberculous carcasses) reported by FSA	15	30	15
SLH cases confirmed by culture of <i>M. bovis</i>	9	18	12

**Appendix 4: Suspected sources of *M. bovis* infection for all the new OTFW and OTFS breakdowns identified in the report period**

<b>Source of infection</b>	<b>Possible (1)</b>	<b>Likely (2)</b>	<b>Most likely (4)</b>	<b>Definite (8)</b>	<b>Weighted contribution</b>
Badgers	26	31	90	1	77.4%
Cattle Movements	17	8	7	0	9.7%
Contiguous	13	8	0	0	4.4%
Residual Infection	10	7	3	0	5.4%
Domestic Animals	0	0	0	0	0.0%
Non-specific Reactor	2	0	0	0	0.8%
Fomites	4	0	0	0	1.0%
Other Wildlife	4	1	0	0	0.8%
Other or Unknown Source	2	0	0	0	0.6%

## **Appendix 5: Overview of the bovine TB Control Programme in Derbyshire**

Summary of TB control measures specific to Derbyshire:

### 5.1 Edge Testing Policy

- From January 2018 six-monthly herd surveillance testing replaced annual herd surveillance testing in the former HRA portion of Derbyshire.
- Radial testing of herds in a 3 km radius around an OTFW breakdown holding continues in the original Edge portion, along with annual surveillance testing.
- All breakdowns in Derbyshire require two consecutive short interval tests with negative results before OTF status is regained.
- Slaughter of Inconclusive Reactors (IRs) disclosed within breakdowns is encouraged along with removal of higher risk in contact cattle as direct contacts where appropriate.
- Exemptions to the interferon gamma testing is applied where there is clear epidemiological separation of certain groups of cattle within the herd after the initial round of testing thus making it more targeted and cost-effective.

### 5.2 Unusual TB breakdowns

- No known cases of human zoonotic TB reported in 2018.
- No cases of fraudulent skin test reactors reported.
- There were no breakdowns involving producer-retailers of unpasteurised milk products in 2018.

### 5.3 Other Testing Measures

- Decoupling of the interferon gamma test from the short interval skin test is the default position, the aim being to apply interferon gamma testing as soon as a breakdown has been confirmed. This is to allow for any exposed or infected animals not detected by the disclosing test to be identified and removed earlier and reduce the duration of the breakdown.
- Discretionary exemptions from annual routine surveillance whole herd testing have been approved for a small number of beef finishing units. The following strict set of criteria is required:
  - All cattle move directly to the abattoir.
  - No cattle to be resident on the holding for more than 12 months.
  - No births in the unit.
  - No breeding activity in the unit
  - All cattle must be permanently housed or yarded (no grazing).
  - Holdings are required to reapply for an exemption on an annual basis in order to ensure regular review of compliance.
- The frequency of overdue tests has diminished following the introduction of cross compliance penalties and movement restrictions on overdue herds. This however is an ineffective means

of ensuring non-claimants or non-commercial herds complete testing on time. The compulsory slaughter of untested herds is an alternative method of enforcement but difficult, and often expensive, to progress with the available resources.

- The results of the Defra-funded Found Dead Badger Survey should assist in determining the presence of *M. bovis* in badgers in that area, particularly in areas which appear to have endemic infection.

#### 5.4 Other Control Measures

- Farmers have been encouraged to take advantage of the free TB Advisory Service visits.
- Restriction of resolved IRs for life to the farm where first identified as an IR.
- Once in a breakdown situation any further testing is done at least 60 days post reactor removal rather than 60 days post reactor isolation. This measure ensures that, in cases where there may have been ineffective isolation of reactors, any animals which may have been exposed to disease while the reactor was awaiting removal will be allowed sufficient time to mount a detectable immune response to the tuberculin skin test.
- Official Veterinarian TB skin testing quality control audits continue to be carried out by APHA in parallel with those being completed by the Veterinary Delivery Partners who are contracted to provide the statutory TB skin testing on behalf of APHA.
- The Derbyshire TB Eradication Board is active.
- Local Authority liaison is maintained as necessary, especially regarding the enforcement of overdue TB tests, illegal movements, fraudulent skin test reactors, and with Public Health colleagues regarding open TB cases or the consumption of unpasteurised milk.

APHA is an Executive Agency of the Department for Environment, Food and Rural Affairs and also works on behalf of the Scottish Government, Welsh Government and Food Standards Agency to safeguard animal and plant health for the benefit of people, the environment and the economy.