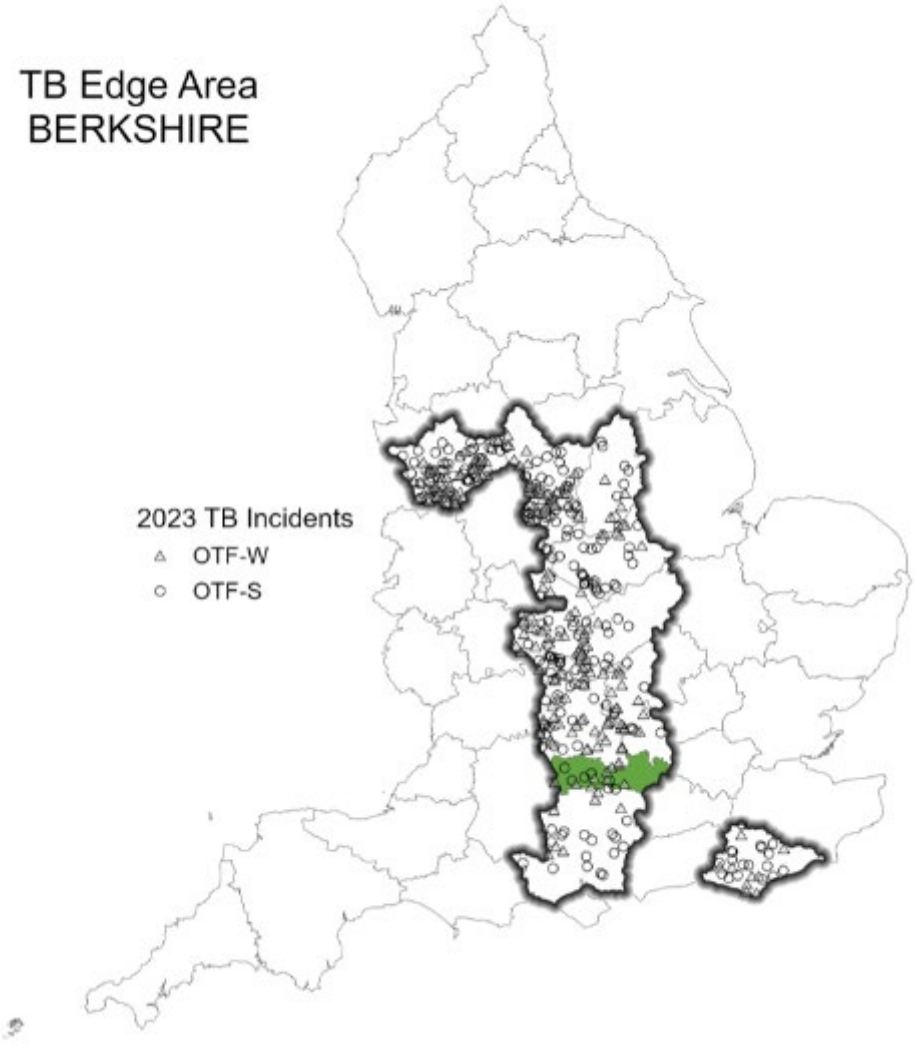
Animal &
Plant Health
Agency

Year End Descriptive Epidemiology Report: Bovine TB in the Edge Area of England 2023 County: Berkshire



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Introduction

The Edge Area was originally established in 2013, along with the Low Risk Area (LRA) and High Risk Area (HRA) of England. In 2014, the 3 bovine tuberculosis (TB) risk areas were incorporated into the UK government's strategy to achieve Officially TB-Free (OTF) status for England by 2038. A key action was to recognise the different levels of TB in different parts of the country and to adjust the approaches to TB surveillance and control in each risk area accordingly. The current aim is to obtain OTF status for the Edge Area as soon as possible.

This report describes the frequency and geographical distribution of TB in cattle herds in Berkshire, an Edge Area county, in 2023. It examines what factors are likely to be driving TB in this area, and the risks the disease in this county may pose to neighbouring areas.

TB in cattle and other mammals is primarily caused by the bacterium *Mycobacterium bovis* (*M. bovis*), and the disease is subsequently referred to in this report as TB. Although other sources may refer to TB 'breakdowns', this report will use the term 'incidents' throughout.

This report is intended for those involved in the control of TB, both locally and nationally. This includes, but it is not limited to, cattle farmers, government and private veterinarians, policy makers and the scientific community.

Details of the data handling methodology used in this report, a glossary of terms, and the TB control measures adopted in the Edge Area, can be found in the explanatory supplement for the annual reports 2023.

Types of TB incidents

Unless otherwise specified, this report includes all new TB incidents detected during the reporting period (1 January to 31 December 2023). This includes both 'Officially Tuberculosis-Free Status Withdrawn' (OTF-W) and 'Officially Tuberculosis-Free Status Suspended' (OTF-S) incidents.

OTF-W incidents are those involving at least one skin test reactor, an animal positive to the Single Intradermal Comparative Cervical Tuberculin (SICCT) test, with either:

- typical lesions of TB identified at post-mortem (PM) meat inspection
- and at least one animal with *M. bovis*-positive polymerase chain reaction (PCR) test (or bacteriological culture) results in tissue samples collected from carcasses during the PM inspection

OTF-S incidents are triggered by reactors to the skin test, but without subsequent detection of TB lesions or positive PCR test (or culture) results in any of those animals.

TB incidents in Approved Finishing Units (AFUs) without grazing are not included in the prevalence and incidence calculations in this report due to the limited epidemiological impact of these incidents.

Furthermore, the number of TB incidents and designation of those incidents as OTF-W or OTF-S may differ in this report compared to other official TB statistics due to differences in the information available at the time datasets are accessed.

Cattle industry

There were 168 cattle herds registered in Berkshire at the end of the year, and beef herds were the predominant cattle enterprise in the county (77%). The majority of herds were small and 54% of them had fewer than 50 cattle, as shown in Appendix 1 and 2.

Berkshire had no livestock markets or abattoirs in 2023. Markets close to Berkshire include Salisbury market in the neighbouring HRA county of Wiltshire, and Thame market in Oxfordshire (Edge Area).

There were 2 AFUs without grazing operating in Berkshire in 2023, as in 2022.

The number of cattle markets in operation in 2023 is captured and maintained centrally by the Animal and Plant Health Agency (APHA) TB Customer Service Centre. Where possible, this data is then subject to further validation by APHA veterinarians subject to their best knowledge of the local area. Some small discrepancies may therefore exist where changes to markets were not captured in time for this report.

Cattle herds in the western half of Berkshire routinely undergo 6-monthly surveillance testing. However, 22% of cattle herds in the 6-month testing area were regarded as having a lower risk of contracting TB, and thus were placed on annual TB testing under the earned recognition scheme in 2023. The rest of cattle herds in Berkshire routinely undergo annual surveillance testing by default.

New TB incidents

A total of 13 new TB incidents were detected in Berkshire in 2023, a decrease of 5 (28%) compared to 2022, as displayed in Figure 1. This was driven by a 36% fall in the number of OTF-W incidents (from 11 in 2022 to 7 in 2023). The number of OTF-S incidents decreased from 7 in 2022 to 6 in 2023.

Since 2018, the number of new TB incidents has steadily declined year-on-year in Berkshire. Although there was a brief increase in 2021, the downward trend has resumed, nearing the levels seen in 2015 and 2016.

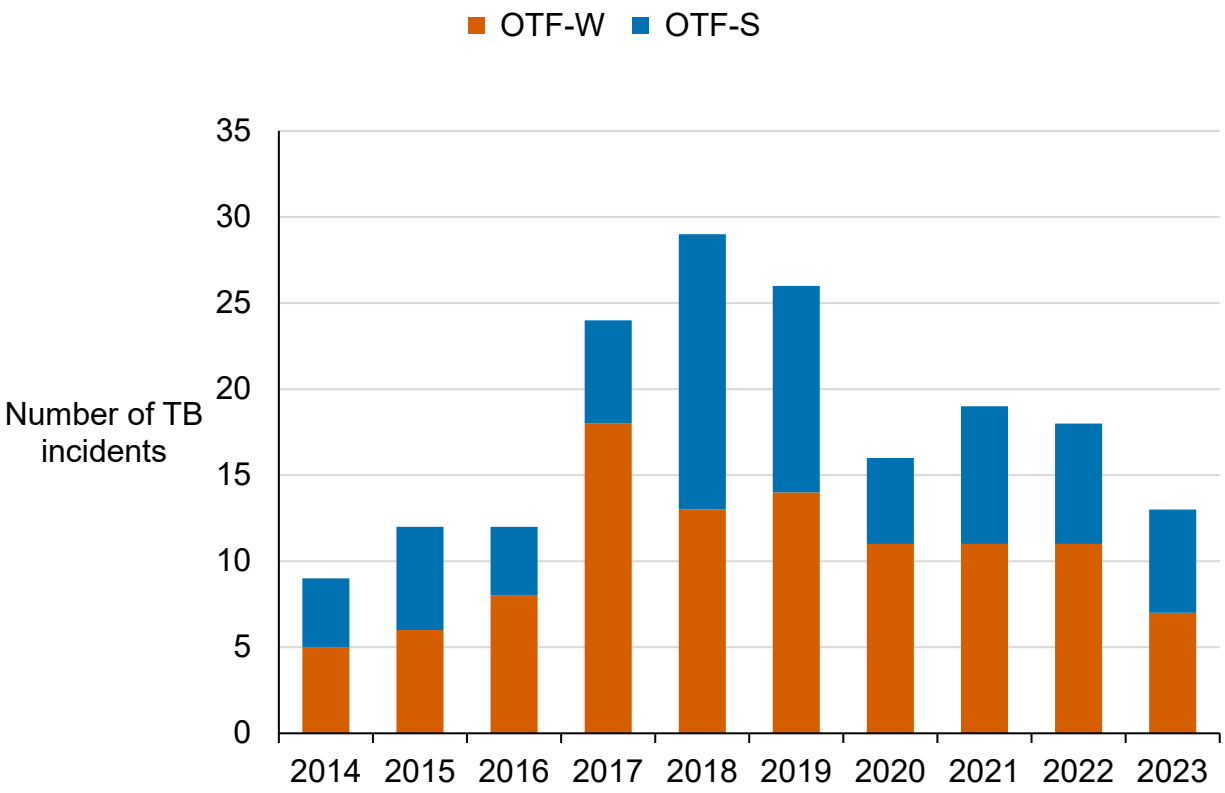

Figure 1: Annual number of new TB incidents in Berkshire, from 2014 to 2023.

Figure 1 description: Bar chart showing the number of confirmed TB incidents (OTF-W, in orange) and suspected (OTF-S, in blue) in the whole of Berkshire between 2014 and 2023. In 2023, there were 13 TB incidents in the whole county, 7 OTF-W and 6 OTF-S.

Disclosing test types

As in previous years, whole-herd routine surveillance herd testing - performed every 6 months or 12 months (12M) continued to detect the most TB incidents in Berkshire in 2023 (n=10). This was followed by slaughterhouse (SLH) surveillance (n=2). One incident was detected by 6-month post-incident check testing (6M), as shown in Figure 2. There were no incidents detected by radial testing in the annual TB testing area of Berkshire for the whole of 2023 due to emergency measures issued in December 2022. This followed the highly pathogenic avian influenza outbreak in 2022 to 2023. During that period all radial testing was temporarily replaced with check testing of herds immediately contiguous to a holding affected by an OTF-W incident.

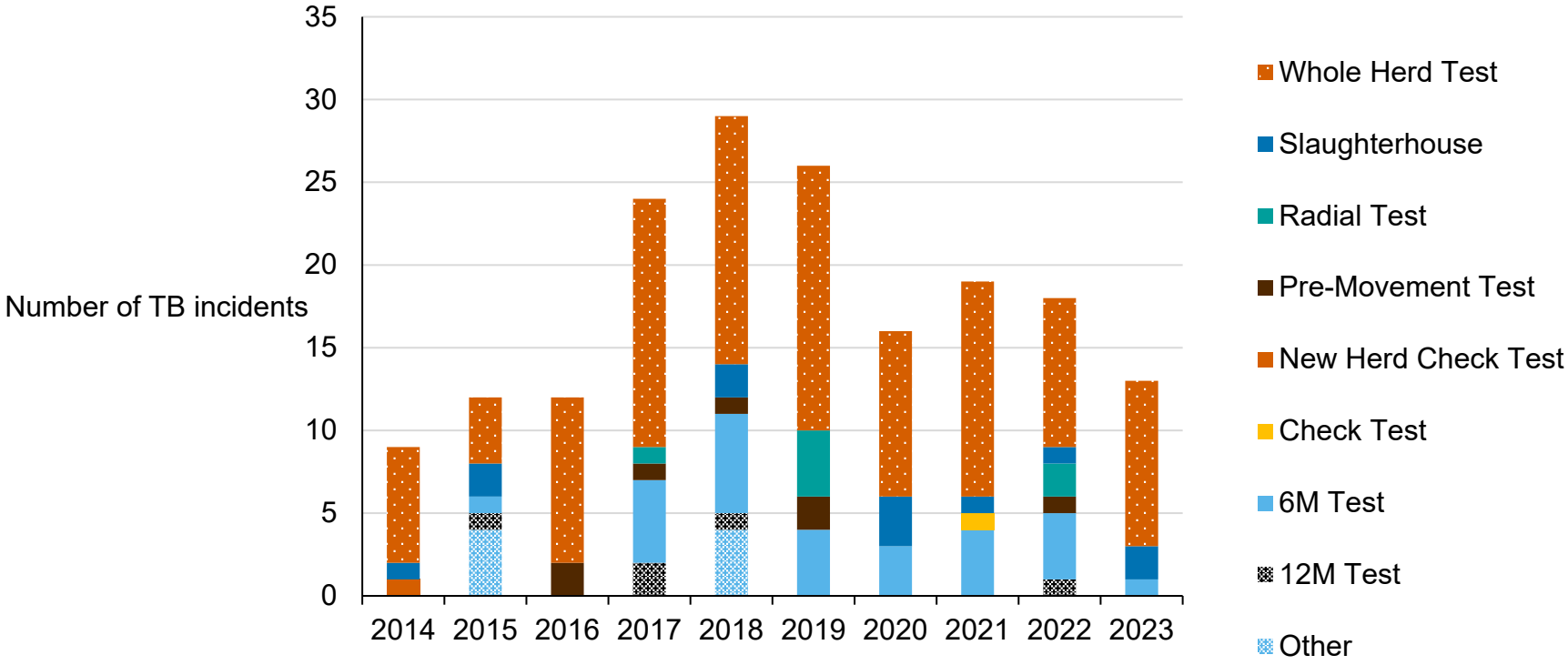

Figure 2: Number of new TB incidents (OTF-W and OTF-S) in Berkshire in 2023, according to the surveillance methods that detected them.

Figure 2 description: A bar chart showing the number of new TB incidents disclosed by test type in Berkshire between 2014 and 2023. In 2023, most incidents were disclosed by whole herd tests (10), followed by SLH cases (2) and a 6-month post-incident test (1).

Duration of TB incidents

A total of 14 TB incidents (10 OTF-W and 4 OTF-S) were resolved in Berkshire during 2023. Of these, 5 had started in 2023, 8 in 2022 and one in 2017.

The median duration of OTF-W incidents that ended in 2023 was 180 days, interquartile range (IQR) 162 to 267. While one incident was resolved within 100 days, most (6 out of 10) were resolved within 240 days. One OTF-W incidents took up to 550 days to resolve, and 3 remained open and under restriction for more than 550 days (which is a persistent TB incident).

The median duration of OTF-S incidents that ended in 2023 was 171 days (IQR 146 to 226). All 4 incidents that ended in 2023 were resolved within 550 days.

The median duration of all incidents (OTF-W and OTF-S) that were resolved in 2023 was 179 days (IQR 161 to 267). This was slightly shorter than the duration of incidents that ended in 2022; 185 days (IQR 157 to 286). For the whole Edge Area, the median duration of TB incidents that ended in 2023 was 188 days (IQR 159 to 265).

There were 11 TB incidents ongoing at the end of the year in 2023. This included the 3 persistent OTF-W TB incidents mentioned above. The number of persistent incidents is the same as in 2021 and 2022.

Unusual TB incidents

Three herds in Berkshire remained under continuous movement restrictions for 12, 11, and 2-and-a-half years, respectively, at the end of 2023, because of continued detection of infected cattle at short interval tests. Two of these persistently infected herds had had a survey for wildlife activity on the farm in 2018 and additional advice on reducing potential cattle-wildlife interactions. With Whole Genome Sequence (WGS), we have been able to link TB suspect deer isolates from 2022 and 2023, to one of these persistent incidents. This shows the close relation between wildlife and cattle in this herd likely contributing to its persistence. These cattle are outside grazing all year round and thus in contact with potential wildlife transmission events of *M. bovis*.

TB in other species

There is no statutory routine TB surveillance of non-bovine species, apart from Post-Mortem Examination (PME) of animals slaughtered for human consumption, or carcasses submitted to veterinary laboratories for diagnostic investigation. Targeted TB testing takes place in non-bovine herds under TB movement restrictions due to laboratory-confirmed incidents of *M. bovis* infection, and in specific herds of camelids, goats and captive deer at an elevated risk of infection. Enhanced voluntary wildlife surveillance takes place in LRA

hotspots, but not within the Edge Area. Outside of these initiatives, farmers and deer stalkers are able to submit wild deer carcasses for private TB testing and the results of these findings are reported below.

In Berkshire, there were no new TB incidents reported in domestic non-bovines in 2023.

In 2023, *M. bovis* was detected by laboratory testing in a carcass of wild (muntjac) deer retrieved near Eling Hermitage. This was in addition to a previous 2 positive carcasses from 2022. WGS analysis was used to analyse the relationship between cattle incidents and wild deer populations in the area. The WGS of these 3 deer isolates were found to be almost identical to one isolate recovered from a cattle incident in the same area and closely related to other incidents in west Berkshire. This suggests that wild deer are also involved in the local spread of TB, in addition to badgers and cattle. However, it is not possible from the limited WGS data to establish the direction of the infection from wild deer to cattle or vice versa.

APHA, in collaboration with the University of Nottingham, conducted a project to detect the presence and location of TB infection in badgers in Buckinghamshire, Oxfordshire, Berkshire, Hampshire and East Sussex - collectively known as the ‘Southern Edge Area’. Volunteers were recruited in each county to help with the safe and timely retrieval of badger carcasses. They were delivered to the University of Nottingham, where they underwent post-mortem examination and testing for the presence of TB infection by culture. Those that tested positive were sent for further WGS and clade identification (genetic strain). The project aimed to collect 100 carcasses of badgers found dead per county, most likely those killed in road traffic accidents (RTAs). Once 100 carcasses of a sufficient quality were examined per county, collection ceased in that county. Once county targets were achieved, all stakeholders were informed. The survey ended in April 2023 and its results will be communicated to all stakeholders once all the bacteriological cultures and WGS analysis have been completed. Its results will help develop a picture of the disease situation in the Southern Edge Area.

Incidence of TB

TB incidence in Berkshire decreased to 9.0 incidents per 100 herd years at risk (HYR) in 2023, down from 11.3 incidents per 100 HYR in 2022, as displayed in Figure 3. This reduction was not statistically significant (incidence rate ratio 0.80, p=0.27) as the overall time herds were under restriction remained similar between both periods.

Berkshire sustained the fourth highest incidence rate out of the 11 counties in the Edge Area. This was higher than the overall rate for the whole of the Edge Area in 2023 (7.2).

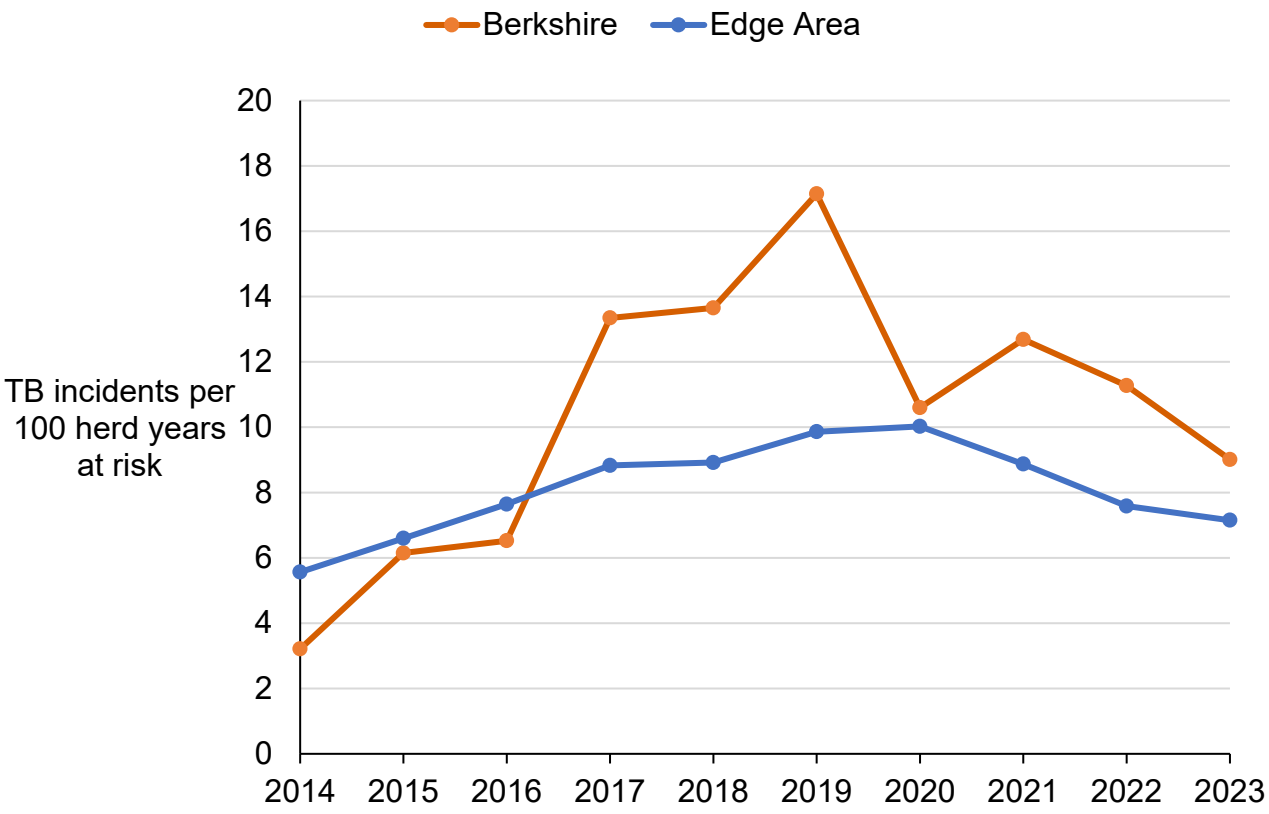

Figure 3: Annual incidence rate (per 100 herd-years at risk) for all new incidents (OTF-W and OTF-S) in Berkshire, from 2014 to 2023.

Figure 3 description: Line chart showing the incidence rate of new TB incidents per 100 herd years at risk (100 HYR) in Berkshire and the overall Edge area between 2014 and 2023. Incidence in Berkshire has been declining since 2021. In 2023, the incidence rate in Berkshire was 9.0 new incidents per 100 HYR and in the Edge Area overall, incidence in 2023 was 7.2 new incidents per 100 HYR.

Prevalence of TB

The end-of-year herd prevalence in Berkshire remained similar in 2023 at 6.15%, from 6.13% in 2022, as indicated in Figure 4. This epidemiological parameter has halved in Berkshire over the past 5 years, from a high of 12.7% in 2018, but it is still twice as high as the overall herd prevalence recorded in the Edge Area (Figure 4).

The decrease in incidence and prevalence since 2018/2019 is likely to be the result of several factors:

- increased routine testing frequency of cattle herds in west Berkshire since 2018, which helps detect infection earlier and reduced spread and residual infection within the herd

- reduced incidence in neighbouring HRA counties where cattle are purchased from,
- more careful sourcing of cattle for example by using the interactive online cattle mapping tool
- some badger control measures

It is also important to note that the number of herds and cattle in Berkshire since 2018 has been steadily declining.

Berkshire had the second highest end of year prevalence out of the 11 counties in the Edge Area. This was higher than the overall rate for the whole of the Edge Area in 2023 (4.17%).

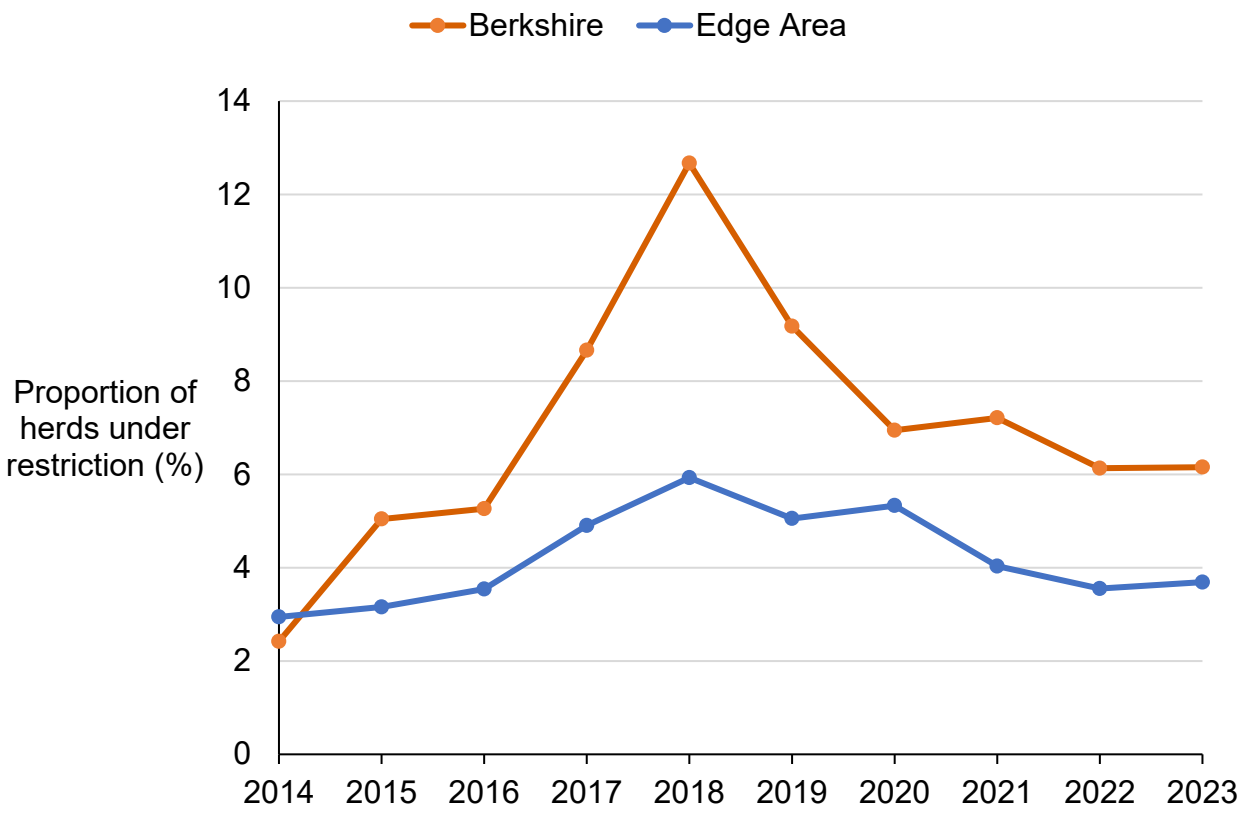

Figure 4: Annual end of year prevalence in Berkshire, from 2014 to 2023.

Figure 4 description: Line chart showing the annual end of year prevalence in Berkshire and within the overall Edge Area, between 2014 and 2023. Annual end of year prevalence has been decreasing consistently since a peak in 2018 in Berkshire. The prevalence has decreased steadily thereafter. In 2023, the end of year prevalence for Berkshire was 6.2% of herds placed under TB restrictions in the county. Prevalence in the Edge Area overall in 2023 was 3.7% of herds.

Recurring TB incidents

Three-year recurrence

In Berkshire, 5 of the 6 (83%) herds with a new OTF-S TB incident in 2023, and 4 of the 7 (57%) with an OTF-W incident, had experienced another TB incident in the previous 3 years, as shown in Figure 5. This is the highest recurrence compared to neighbouring Edge Area counties of Oxfordshire, Buckinghamshire and Hampshire.

Compared to the whole of the Edge Area, where 54% of herds experienced recurring TB incidents, Berkshire had the joint highest recurrence with Cheshire (both 69%).

Recurrence of an incident in the same herd is a problem in west Berkshire. Residual infection remaining in the herd from a previous incident, and reinfection from other sources, especially wildlife, explains most of the OTF-W recurrent incidents. This aligns with a history of TB being a risk factor for a herd to sustain a new recurrent incident. This is due to residual undetected infection remaining in the herd but can also be present locally in infected wildlife.

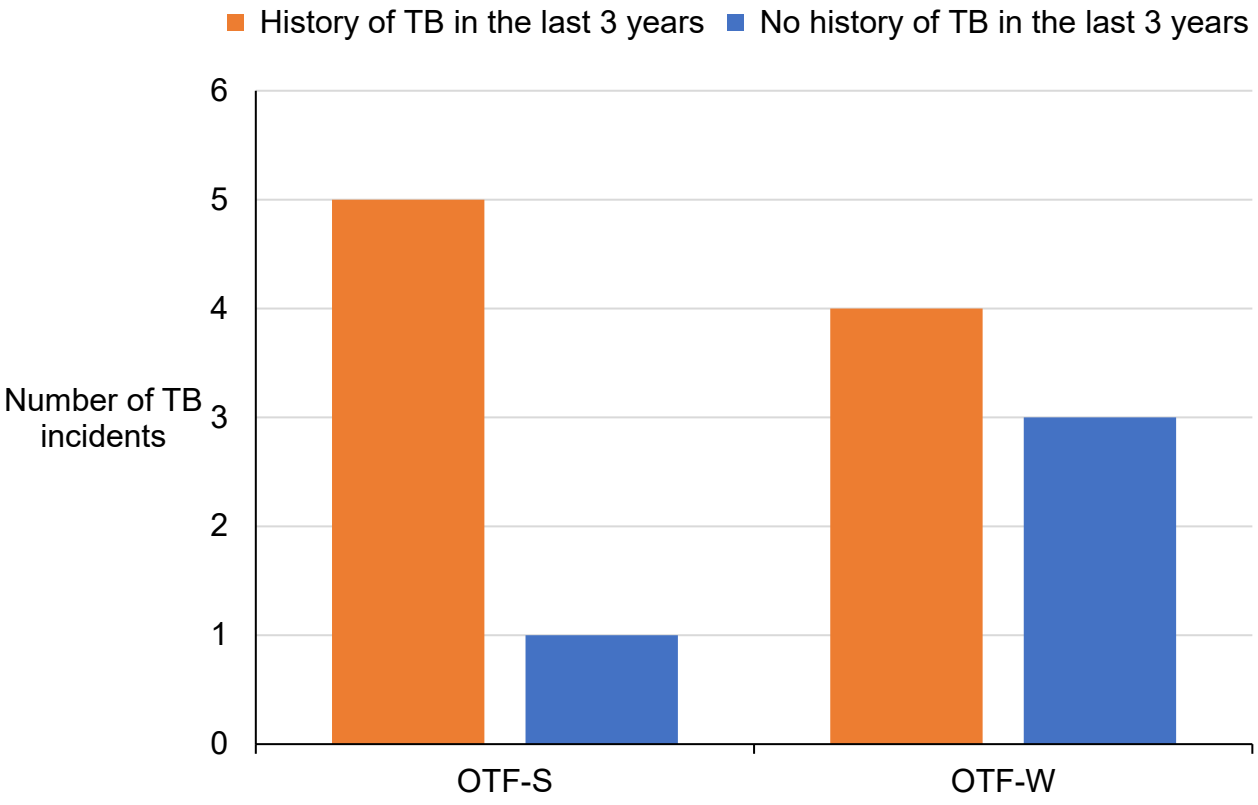

Figure 5: Number of herds with a TB incident (by OTF-W and OTF-S) in Berkshire in 2023, with and without a history of any TB incident in the previous three years.

Figure 5 description: Bar chart showing the number of herds with (in orange) and without (in blue) a history of a TB incident in the last three years in 2023, for OTF-S and OTF-W herds. A description of the data is provided in the text.

Overall recurrence

As shown in Figure 6, in 2023, 85% of incidents reported across the county occurred in herds with a history of TB in the herd's lifetime (6 out of 6 OTF-S and 5 out of 7 OTF-W). Of the 2 OTF-W incidents without any previous history of TB, one is a new herd and the other one moved cattle from one location to another and so not representative of herds at risk of recurrence.

Overall recurrence of TB increased compared to 2022 (67%, 5 out of 7 OTF-S and 7 out of 11 OTF-W). One reason for this might be the reduced number of supplementary interferon gamma (IFN-γ) blood tests carried out in the west of Berkshire since July 2021, when only those herds experiencing a recurrent or persistent OTF-W incident in the 6-month testing portion of the Edge Area became eligible for mandatory IFN-γ testing, as opposed to all OTF-W incidents in the annual TB surveillance testing portion. The number of IFN-γ test-positive cattle removed since 2021 has reduced (from 80 in 2021, 4 in 2022, 19 in 2023), whereas the number of SLH cases detected in OTF herds or in herds with ongoing TB incidents in Berkshire has increased (from one in 2021, to 10 in 2022 and 12 in 2023 – see Appendix 2 table 4). This may have been due to residual infection remaining in the herds due to fewer IFN-γ testing being completed.

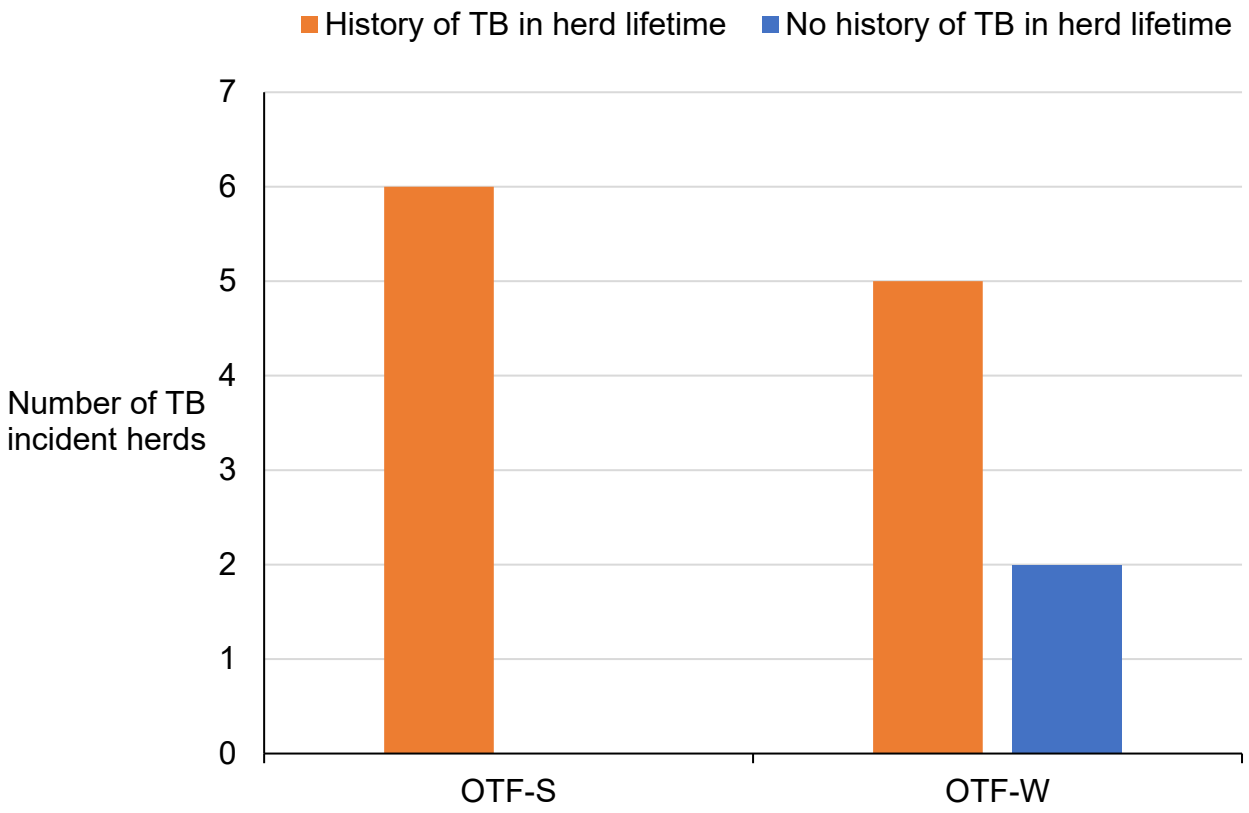

Figure 6: Number of herds with a TB incident (by OTF-W and OTF-S) in Berkshire in 2023, with and without a history of any TB incident during the herd's lifetime.

Figure 6 description: Bar chart showing the number of herds with (in orange) and without (in blue) a history of a TB incident during the herd's lifetime in 2023, for OTF-S and OTF-W herds. A description of the data is provided in the text.

Geographical distribution of TB incidents

As indicated in Figure 7, and similar to previous years, the majority of the new TB incidents in 2023 were within the western half of the county. In this area most herds are routinely tested for TB every 6 months and the cattle density is higher than in the eastern half. As in previous years, the strain of *M. bovis* identified in most OTF-W incidents in Berkshire was WGS clade B6-62. Two of these incidents occurred towards the centre of the county in areas where other OTF-W incidents had previously been detected. One incident with clade B6-62 was located to the southwest on the border with Wiltshire. Another incident was located further east towards the border with northern Hampshire.

Only one new TB incident occurred in the annual testing area of the east of Berkshire. This incident was associated with clade B6-11 of *M. bovis*, which has a homerange in the west of England, from south Cheshire to Avon and Wiltshire, and in parts of Wales. WGS phylogenetic analysis revealed that the strain of *M. bovis* isolated from the test reactors on

the farm in east Berkshire were related to the strain isolated at the farm of origin of these reactors in Warwickshire in 2021 and 2022, thus confirming hypothesis of a TB incident caused by the introduction of *M. bovis*-infected cattle.

The causative WGS clade was undetermined for 2 OTF-W incidents.

In 2023, OTF-S incidents were distributed throughout the 6-month testing area of Berkshire.

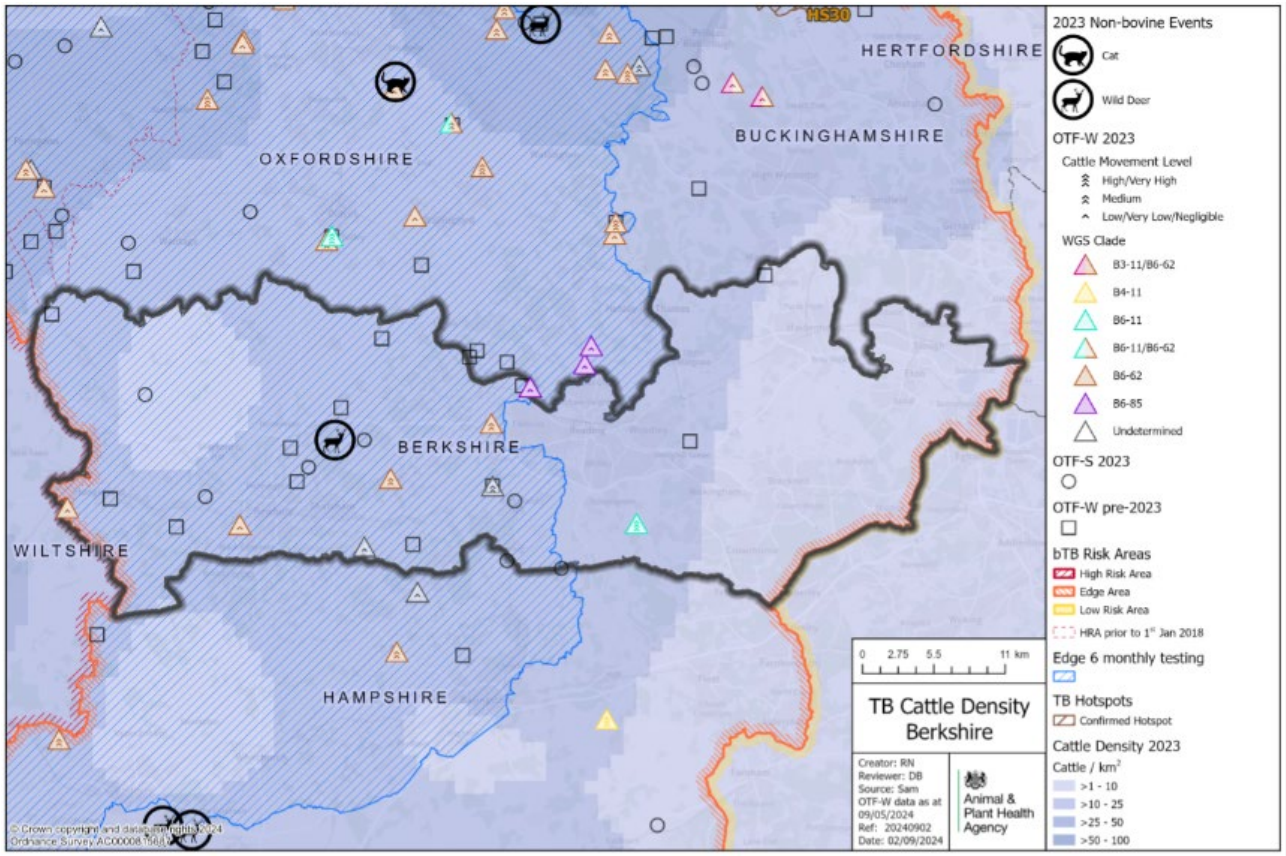

Figure 7: Location of cattle holdings in Berkshire with new TB incidents (OTF-W and OTF-S) in 2023 and cattle holdings with pre-2023 OTF-W incidents still ongoing at the beginning of 2023, overlaid on a cattle density map. The movement score for each farm is symbolised with 3 chevrons for cattle movements associated with a high likelihood of infection, 2 chevrons for a medium likelihood and 1 chevron for a low likelihood.

Figure 7 description: Map of the Berkshire county showing the locations of cattle holdings in Cheshire with new TB incidents (OTF-S and OTF-W) in 2023 and pre-2023 OTF-W incidents on the map. The 2023 OTF-W incidents are shown as triangles, 2023 OTF-S as circles and pre-2023 OTF-W as squares. The 2023 OTF-W incidents are also coloured by WGS clade and contain chevrons to show the cattle movement algorithm score allocated to the incident (low/medium/high risk of cattle movements). Most incidents occurred in the

centre and west of the county in the annual testing area – further detail provided in the text.

New and established areas of TB in Berkshire have been identified by clustering incidents using WGS. One of these clusters is described below, affecting herds in this county in 2023.

In 2023, 3 incidents in the Newbury Cluster area were investigated using WGS. All 3 incidents were identified as being part of a cluster within the B6-62 phylogenetic tree, located in the same geographical area. This cluster includes incidents from Berkshire dating back to 2017 and several *M. bovis* isolates from a cluster of tuberculous cats disclosed in 2013 west of Newbury and linked to contact with local infected wildlife.

Other likely clusters are prevalent in Berkshire, some originating from neighbouring counties like Oxfordshire (Edge Area) and Wiltshire (HRA), while others have been present in this county for many years, and previously defined as spoligotype 10:u.

Skin test reactors and interferon gamma test positive animals removed

Appendix 2 provides a summary of headline cattle TB statistics in Berkshire. A total of 100 cattle were removed from TB incidents in Berkshire during 2023, as shown in Figure 8. The tuberculin skin test detected 81 infected animals and 19 were detected through the IFN-γ blood test. This is a decrease of 13 positive cattle removed in 2022. The proportion of skin (81%) to IFN-γ blood (19%) test reactors differed from that of 2022.

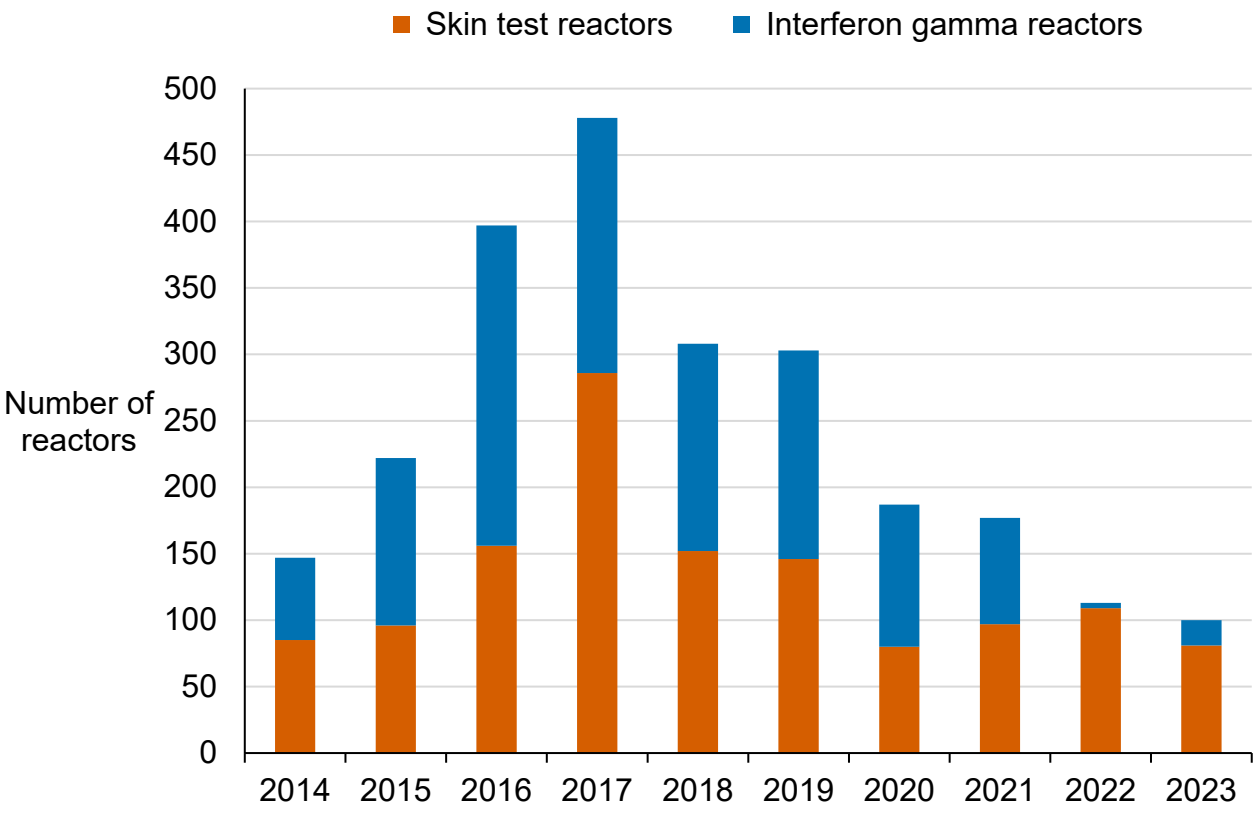

Figure 8: Number of skin test reactors and IFN-γ test positive cattle removed by APHA for TB control reasons in Berkshire, from 2014 to 2023.

Figure 8 description: Bar chart showing the number of skin test reactors and IFN-γ test reactors removed for TB control reasons in Berkshire between 2014 and 2023. In 2023, 81 skin test reactor cattle and 19 IFN-γ reactors were removed in Berkshire, the lowest number in the last 10 years.

Main risk pathways and key drivers for TB infection

It is important to try to understand the risk pathways and key drivers that are likely to have introduced TB infection into a herd. This information can help identify biosecurity measures that may reduce the TB risk for individual businesses.

Implementing practical measures can help to reduce the risk of TB incursion into a herd that is TB free (biosecurity), as well slowing disease spread within a herd where TB is present (biocontainment).

Furthermore, the ibTB online cattle mapping tool can be used to inform purchasing choices, reducing the risk of introducing undetected infection when moving cattle into a herd.

In 2023, 5 out of 13 (38%) new TB incidents in Berkshire received a preliminary or final APHA veterinary investigation to identify the source of infection. The findings from this investigation are reported in Appendix 3. Not all investigations were carried out in 2023. This was due to the continued impact and diversion of field resources as part of the 2022 to 2023 avian influenza outbreak, which continued into spring 2023, in addition to the Bluetongue virus outbreak from summer 2023 onwards.

New data-driven methods to quantify the likelihood of risk pathways for TB infected herds have been developed by APHA. These include the:

- cattle movement algorithm
- WGS local transmission of infection indicator

The cattle movement algorithm uses cattle movement data to identify individual animals that were moved into a TB incident herd as having a negligible, very low, low, medium, high or very high likelihood of being the source of the TB infection. At the herd level, the cattle movement score is dictated by the animal with the highest ranked movement into that herd. Herds are classified as having either:

- cattle movements associated with a high likelihood of infection (a herd with any movements scored as a high or very high likelihood)
- no cattle movements with a high likelihood of infection (the highest likelihood score was negligible, very low, low or medium)

The WGS local transmission of infection indicator uses WGS data from cattle *M. bovis* isolates to identify TB incidents that are linked by genetics, time and space. A TB incident where at least one other TB incident is identified that satisfies all the following 3 criteria is considered to have evidence of a local transmission event:

- it has a WGS with no more than three single nucleotide polymorphism (SNP) differences relative to the TB incident of interest
- it is within 4 years before or 6 months after the start date of the incident of interest
- it is within a 9km radius of the incident of interest

Further details about the methodology used can be found in the explanatory supplement to the annual reports 2023.

There is always a degree of uncertainty about the estimated true routes of TB infection into a herd. The absence of a local transmission event, or cattle movements associated with a high likelihood of infection does not completely negate these pathways. Nonetheless, the evidence provided by the cattle movement and WGS data, when combined, can provide valuable insights into the possible risk pathways. Figure 8 provides the percentage of herds where each risk pathway combination was identified. The spatial distribution of these categories is presented in Figure 9. Each category is described in greater detail in the following text.

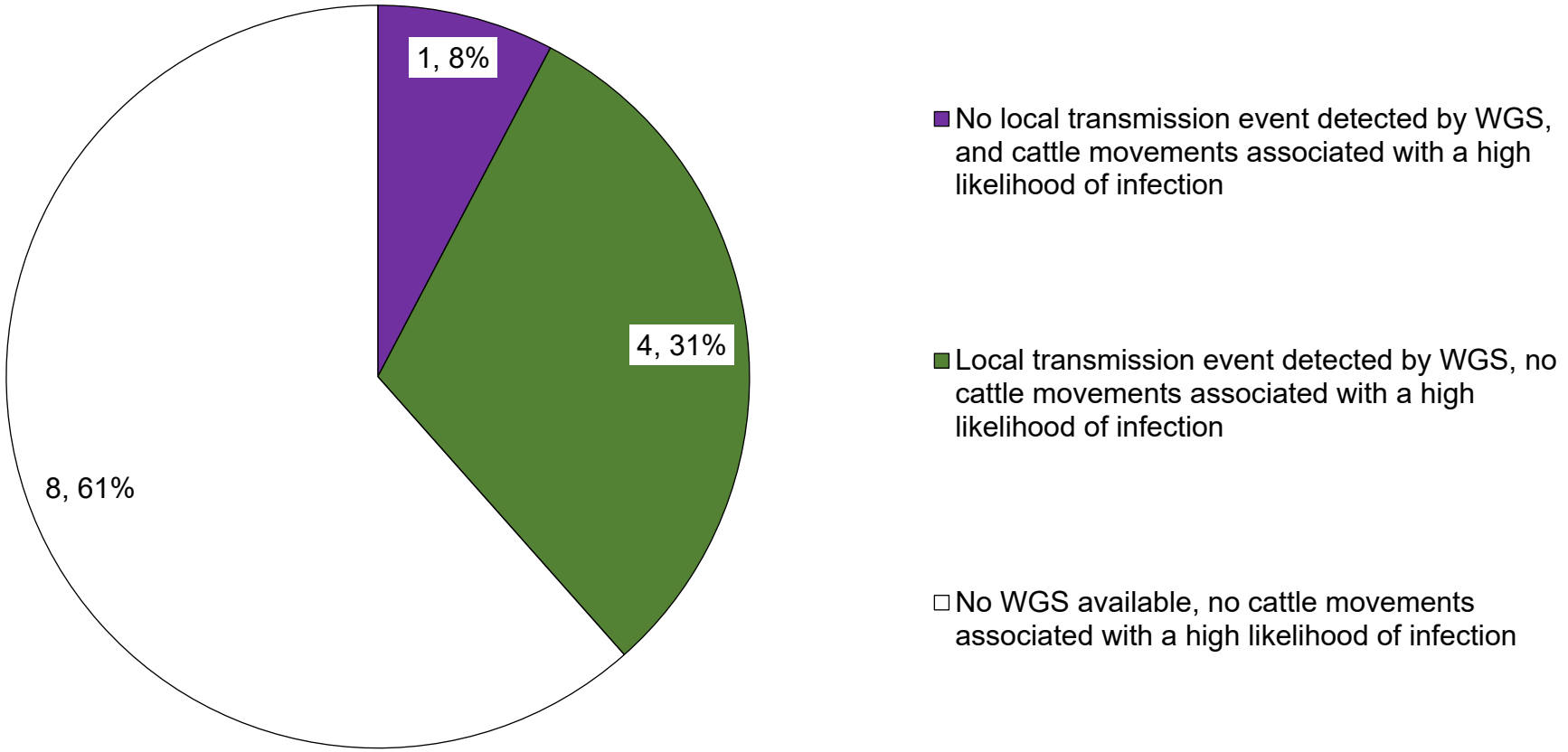

Figure 9: Risk pathway combinations identified by the WGS local transmission of infection indicator and cattle movement algorithm for all 18 new TB incidents starting in Berkshire in 2023.

Figure 9 description: Pie chart showing the risk pathway combinations identified by the WGS local transmission of infection indicator and cattle movement algorithm for all 18 new TB incidents in Berkshire in 2023. Most (8, 61%) did not have any WGS and no cattle movements were identified with a high likelihood of infection. Further description provided in the text.

WGS data was available for 5 (38%) of all new TB incidents in Berkshire. The WGS local transmission of infection indicator identified potential local transmission event for 4 (31%) new TB incidents in 2023.

Most of the TB incidents with WGS data available had a local transmission event identified without strong evidence of cattle movements (4, 31%). These are dark green symbols in Figure 10.

For these incidents, a broad spectrum of local pathways cannot be ruled out, including:

- residual infection in the herd
- contiguous contact with infected cattle
- direct or indirect contact with potentially infected wildlife

One new TB incident had evidence of cattle movements associated with a high or very high likelihood of TB infection, and no evidence of a local transmission event where WGS was available. For this herd, it was considered more likely than not that cattle movements contributed to the introduction of infection (dark purple symbols, Figure 10).

For a further 8 new TB incidents in 2023 (62%), there was no evidence of cattle movements associated with a high likelihood of TB infection, and no WGS data available to explore the presence of a local indicator. These are shown as white dots in Figure 10, as there is insufficient evidence to determine a likely infection pathway.

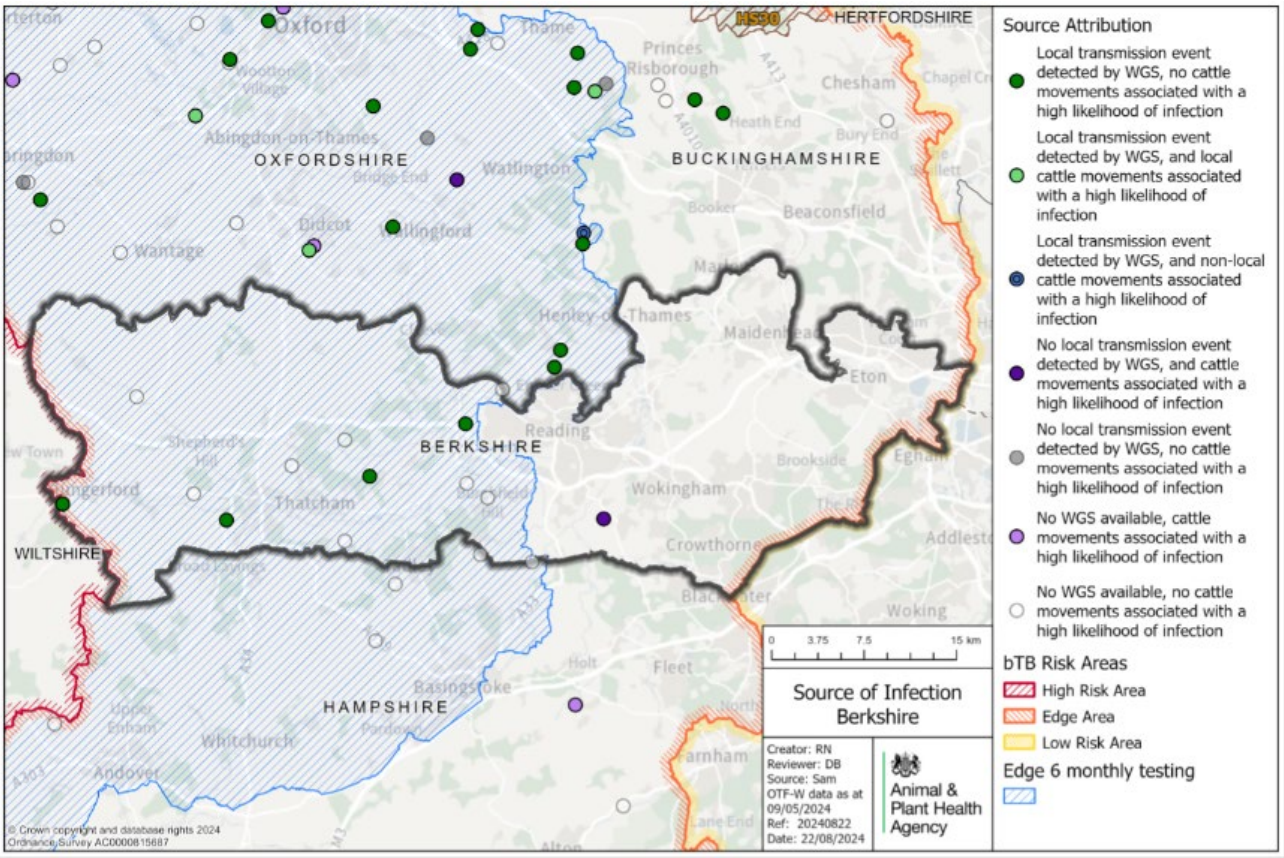

Figure 10: Map of the available evidence for risk pathways of TB infection into the herd, for all TB incidents (OTF-W and OTF-S) in Berkshire that started in 2023.

Figure 10 description: Map of the Berkshire county showing the locations of the 18 new TB incidents in Berkshire, coloured by the risk pathway identified for the incident. Dark green are herds with a local transmission event was identified from WGS and no cattle movements with a high likelihood of infection were identified in the herd; light green represents incidents where local transmission event was identified from WGS and cattle movements with a high likelihood of infection were identified in the herd. Dark purple represents incidents where no local transmission event was identified from WGS and there were cattle movements identified with a high likelihood of infection in the herd. Light purple represents incidents with no WGS available and where there were cattle movements identified with a high likelihood of infection in the herd. Grey shows incidents where no local transmission event was identified from WGS and there were no cattle movements with a high likelihood of infection were identified in the herd either. White shows incidents with no WGS available and where there were no cattle movements with a high likelihood of infection were identified in the herd either. A breakdown of the incidents by group is provided in the text.

Genotyping was replaced with WGS of *M. bovis* isolates at Animal and Plant Health Agency (APHA) in 2021. Most OTF-W incidents in Berkshire in 2023 were caused by infection with WGS clade B6-62 of *M. bovis* (see Figure 11). WGS clade B6-62

encompasses the previously designated spoligotype 10, as well as other closely related spoligotypes.

Genotype 10:a and 10:u (both equivalent to clade B6-62) were first disclosed in Berkshire in around 2010 and have been present and spreading across the county since then. Genotype 10:a had been present before this time in the area of Wiltshire bordering Berkshire, suggesting the original incursion was from the west, possibly via north-west Hampshire. It is currently well established in the centre of this county as shown by WGS.

As in 2022, WGS clade B6-85 continued to spread southwards from Oxfordshire's Henley Cluster. In 2023, there was one B6-85 incident that occurred in Oxfordshire, just north of the boundary with Berkshire. The absence of cattle movements associated with a high likelihood of TB infection into this holding supports the likelihood of local wildlife being a probable source of infection.

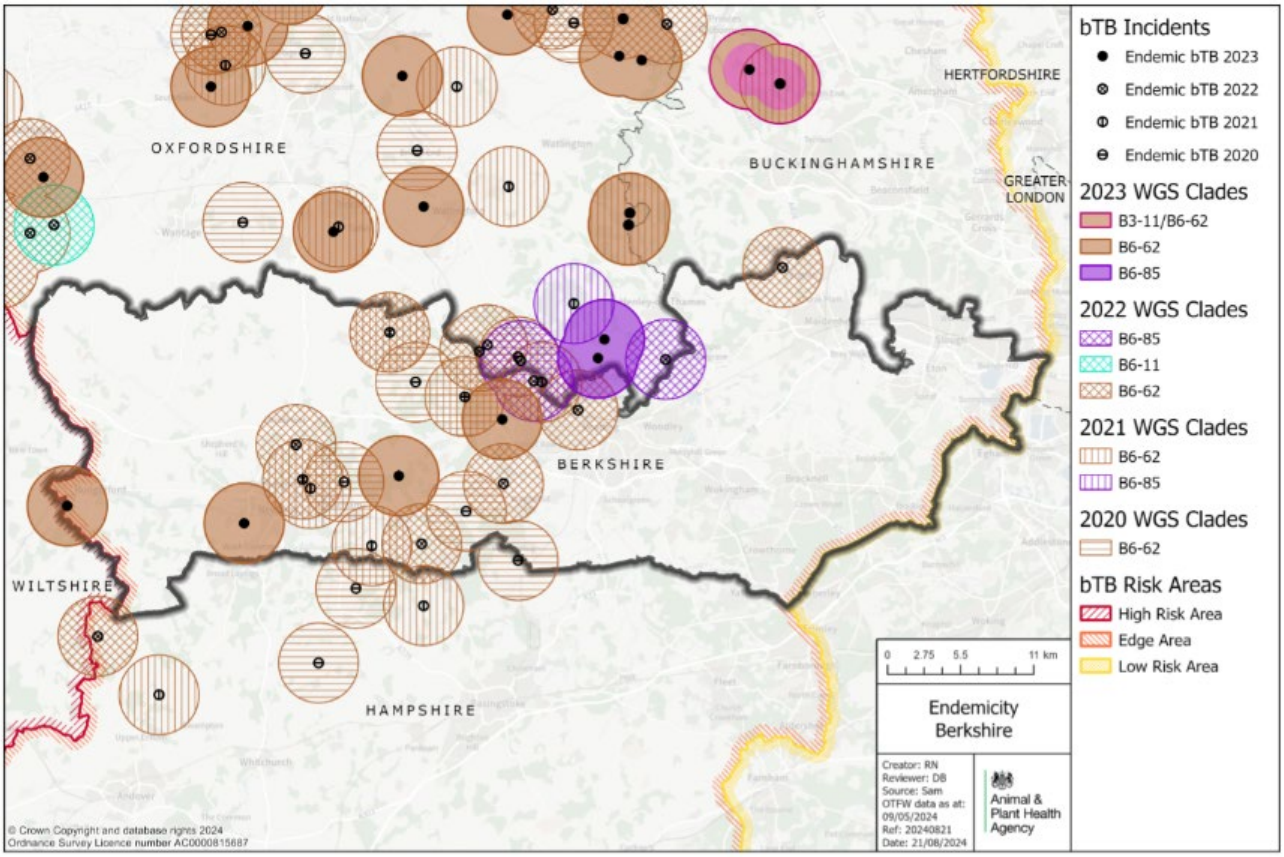

Figure 11: WGS clades of *M. bovis* detected in Berkshire between 2020 and 2023, where the WGS identified in the infected herd was within 3 SNPs of another TB incident in the past 4 years and 9km (OTF-W incidents only).

Figure 11 description: Map of Berkshire showing the WGS clades of *M. bovis* detected in Berkshire between 2020 and 2023, where the WGS identified in the infected herd was within 3 SNPs of another OTF-W incident in the past 4 years and within 9km of it. Clades are shown as circles on the map with each clade represented by a different colour. The year from which the clade was identified is shown by either having the colour be solid

(2023) or different types of hash (2022 to 2020). All incidents show in the central parts of Berkshire. Further detail is provided in the text.

Forward look

The number of new TB incidents in the county decreased in 2023 compared to 2022, continuing the downward trend from the peak of OTF-W incidents in 2017. In the east of Berkshire, there was only one TB incident in 2023 associated to cattle movements. The spread of infection eastwards from west Berkshire appears to have been arrested; with the caveat there are fewer cattle herds to act as sentinels for detection of infection in wildlife in that part of the county.

Six-month surveillance testing of cattle herds in the west of Berkshire has likely helped to reduce the spread of TB through earlier detection of disease in past years. This should lead to shorter incidents with fewer reactors by reducing the available period for cattle-to-cattle spread within herds. Nonetheless, the level of recurrence has remained high, likely due to a reduction of gamma testing since July 2021 and de-prioritisation in 2022 and early 2023 due to diversion of APHA resources to the control of exotic disease outbreaks.

In the west of the county, there is evidence of infected wildlife acting as a transmission event and potential source of infection for cattle. *M. bovis* WGS clade B6-62 has been isolated over several years in clusters of cattle incidents and infected wildlife which are closely genetically related. Further improvements in on-farm biosecurity to reduce transmission between wildlife and cattle are needed to break the cycle of infection, alongside continued wildlife disease control measures including badger culling or vaccination, and local control of the wild deer population, where appropriate.

Cattle movements remain an important source of TB in this county. Careful, informed purchasing by cattle keepers should be encouraged, including the use of the online cattle mapping tool ibTB.

Looking at the recent trend, the likelihood of achieving a herd prevalence of less than 1% OTF-W incidents in Berkshire by 2025 is low.

Appendix 1: cattle industry demographics

Table 1: Number of cattle herds by size category in Berkshire as of 31 December 2023 (RADAR data on number of holdings in the report year)

Size of herds	Number of herds in Berkshire
Undetermined	4
1 to 50	91
51 to 100	33
101 to 200	20
201 to 350	12
351 to 500	2
Greater than 500	6
Total number of herds	168
Mean herd size	97
Median herd size	40

Table 2: Number (and percentage of total) of animals by breed purpose in Berkshire as of 31 December 2023 (Sam data showing the number of herds flagged as active at the end of the report year)

Breed purpose	Number (and percentage of total) cattle in Berkshire
Beef	12,691 (77%)
Dairy	3,330 (20%)
Dual purpose	318 (1%)
Unknown	2 (0.012%)
Total	16,341

Appendix 2: summary of headline cattle TB statistics

Table 3: Herd-level summary statistics for TB in cattle in Berkshire between 2021 and 2023 (SAM data)

Herd-level statistics	2021	2022	2023
(a) Total number of cattle herds live on Sam at the end of the reporting period	210	214	197
(b) Total number of whole herd skin tests carried out at any time in the period	278	283	257
(c) Total number of OTF cattle herds having TB whole herd tests during the period for any reason	170	169	157
(d) Total number of OTF cattle herds at the end of the report period (herds not under any type of TB movement restrictions)	186	193	178
(e) Total number of cattle herds that were not under restrictions due to an ongoing TB incident at the end of the report period	194	200	184
(f.1) Total number of new OTF-S TB incidents detected in cattle herds during the report period	8	7	6
(f.2) Total number of new OTF-W TB incidents detected in cattle herds during the report period	11	11	7
(g.1) Of the new OTF-W herd incidents, how many can be considered the result of movement, purchase or contact from or with an existing incident based on current evidence?	4	1	1
(g.2) Of the new OTF-W herd incidents, how many were triggered by skin test Reactors or twice-inconclusive reactors (2xIRs) at routine herd tests?	7	6	4

Herd-level statistics	2021	2022	2023
(g.3) Of the new OTF-W herd incidents, how many were triggered by skin test Reactors or 2xIRs at other TB test types (such as forward and back-tracings, contiguous or check tests)?	4	5	3
(g.4) Of the new OTF-W herd incidents, how many were first detected through routine SLH TB surveillance?	1	1	2
(h.1) Number of new OTF-W incidents revealed by enhanced TB surveillance (radial testing) conducted around those OTF-W herds	0	1	0
(h.2) Number of new OTF-S incidents revealed by enhanced TB surveillance (radial testing) conducted around those OTF-W herds	0	1	0
(i) Number of OTF-W herds still open at the end of the period (including any ongoing OTF-W incidents that began in a previous reporting period)	10	11	8
(j) New confirmed (positive *M. bovis* culture) incidents in non-bovine species detected during the report period (indicate host species involved)	1 wild fallow deer	2 wild muntjac deer	1 wild muntjac deer
(k.1) Number of grazing approved finishing units active at end of the period	0	0	0
(k.2) Number of non-grazing approved finishing units active at end of the period	2	2	2
(k.3) Number of grazing exempt finishing units active at end of the period	0	0	0
(k.4) Number of non-grazing exempt finishing units active at end of the period	0	0	0

Table 4: Animal-level summary statistics for TB in cattle in Berkshire between 2021 and 2023

Animal-level statistics (cattle)	**2021**	**2022**	**2023**
(a) Total number of cattle tested with tuberculin skin tests or additional IFN-γ blood tests in the period (animal tests)	34,162	34,844	34,073
(b.1) Reactors detected by tuberculin skin tests during the year	97	109	81
(b.2) Reactors detected by additional IFN-γ blood tests (skin-test negative or Inconclusive Reactor [IR] animals) during the year	80	4	19
(c) Reactors detected during year per incidents disclosed during year	9.3	6.3	7.7
(d) Reactors per 1,000 animal tests	5.2	3.2	2.9
(e.1) Additional animals slaughtered during the year for TB control reasons (dangerous contacts, including any first time IRs)	19	21	10
(e.2) Additional animals slaughtered during the year for TB control reasons (private slaughters)	0	0	0
(f) SLH cases (suspect tuberculous carcasses) reported by Food Standards Agency (FSA) during routine meat inspection	1	10	14
(g) SLH cases confirmed by *M. bovis* PCR testing or bacteriological culture	1	10	12

Note (c) Reactors detected during year per incidents disclosed during year, reactors may be from incidents disclosed in earlier years, as any found through testing during the report year count in the table above.

Note (g) SLH cases confirmed by culture of *M. bovis*, not all cases reported are submitted for culture analysis. All cases reported are from any period prior to or during restrictions.

Appendix 3: suspected sources of *M. bovis* infection for all the new OTF-W and OTF-S incidents identified in the report period

In 2023, 5 out of 13 (38%) new TB incidents in Berkshire received a preliminary or final APHA veterinary investigation to identify the source of infection. Not all Disease Report Form (DRF) investigations were carried out in 2023. This was due to the continued impact and diversion of field resources as part of the 2022 to 2023 avian influenza outbreak, which continued into spring 2023, in addition to the Bluetongue Virus outbreak from summer 2023 onwards.

Each TB incident could have up to 3 potential risk pathways identified. Each risk pathway is given a score that reflects the likelihood of that pathway bringing TB into the herd. The score is recorded as either:

- definite (score 8)
- most likely (score 6)
- likely (score 4)
- possible (score 1)

The sources for each incident are weighted by the certainty ascribed. Any combination of definite, most likely, likely, or possible can contribute towards the overall picture for possible routes of introduction into a herd. If the overall score for a herd is less than 6, then the score is made up to 6 using the ‘Other or unknown source’ option. Buffering up to 6 in this way helps to reflect the uncertainty in assessments where only ‘likely’ or ‘possible’ sources are identified.

Table 5 combines the data from multiple herds and provides the proportion of pathways in which each source was identified, weighted by the certainty that each source caused the introduction of TB. The output does not show the proportion of herds where each pathway was identified (this is skewed by the certainty calculation). WGS of *M. bovis* isolates can be a powerful tool in identifying a likely source of infection, however WGS clades are not determined for OTF-S herds. As a result of varying levels of uncertainty, only broad generalisations should be made from these data. A more detailed description of this methodology is provided in the explanatory supplement for the annual reports 2023.

Table 5: Suspected sources of *M. bovis* infection for the 5 incidents with a preliminary or a final veterinary assessment in Berkshire, in 2023

Source of infection	Possible (1)	Likely (4)	Most likely (6)	Definite (8)	Weighted contribution
Badgers	0	2	1	0	27.6%
Cattle movements	0	1	1	0	24.4%
Contiguous	0	0	0	0	0.0%
Residual cattle infection	3	1	0	0	14.7%
Domestic animals	0	0	0	0	0.0%
Non-specific reactor	0	0	0	0	0.0%
Fomites	0	0	0	0	0.0%
Other wildlife	0	3	0	0	30.0%
Other or unknown source	0	0	0	0	3.3%

Please note that each TB incident could have up to 3 potential pathways so totals may not equate to the number of actual incidents that have occurred.

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