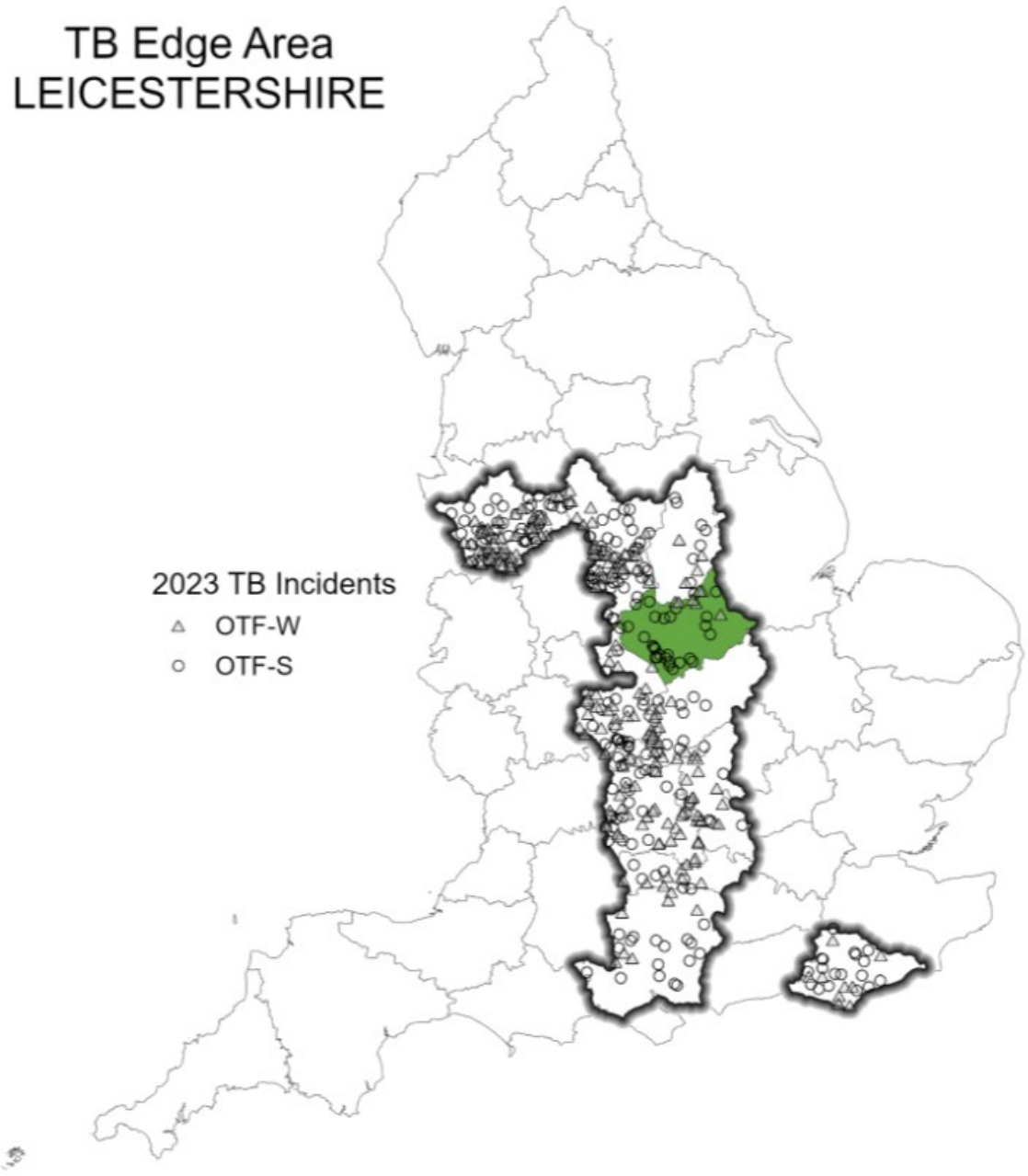
Animal &
Plant Health
Agency

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

County: Leicestershire



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Introduction

The Edge Area was originally established in 2013, along with the Low Risk Area (LRA) and High Risk Area 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 Leicestershire, 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 'Incidents', 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 This includes both 'Officially Tuberculosis-Free Status Withdrawn' (OTF-W) and 'Officially Tuberculosis-Free Status Suspended' (OTF-S) incidents.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
- 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

Beef is the predominant cattle enterprise in Leicestershire (64% of cattle). However, there is a significant number of large dairy herds, most of which are in the north-east of the county. As in previous years, the majority of herds (480, 62%) had fewer than 100 cattle, with a median size of 64 cattle. This is indicated in Appendix 1.

There is one livestock auction market for cattle in Leicestershire: Melton Mowbray Market. This market was approved by the Animal and Plant Health Agency (APHA) in 2018 to hold dedicated sales for TB-restricted cattle. There were 12 AFUs in Leicestershire in 2023, as listed in Appendix 2. This was a reduction by 2 from 2022.

The number of cattle markets in operation in 2023 is captured and maintained centrally by the 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.

All herds in Leicestershire undergo annual (12-monthly) testing.

New TB incidents

The number of new TB incidents in Leicestershire decreased by a third in 2023 compared to 2022, from 51 to 34, as shown in Figure 1. This is the third consecutive year that the total number of new TB incidents decreased in the county, and the lowest number of incidents in the last decade.

Between 2014 and 2023 there has been a changing picture in Leicestershire incidents. The number of total new incidents had been increasing between 2014 and 2020, from 37 (15 OTFW or 22 OTFS) to 64 (33 OTFW or 31 OTFS) in 2020. However, incidents have been falling since.

The overall yearly decrease in incidents was driven by a 68% decrease in OTF-W incidents from 22 in 2022 to 7 in 2023, which was also the lowest number of OTF-W incidents in the last decade. There was a minor decrease in new OTF-S incidents from 29 in 2022 to 27.

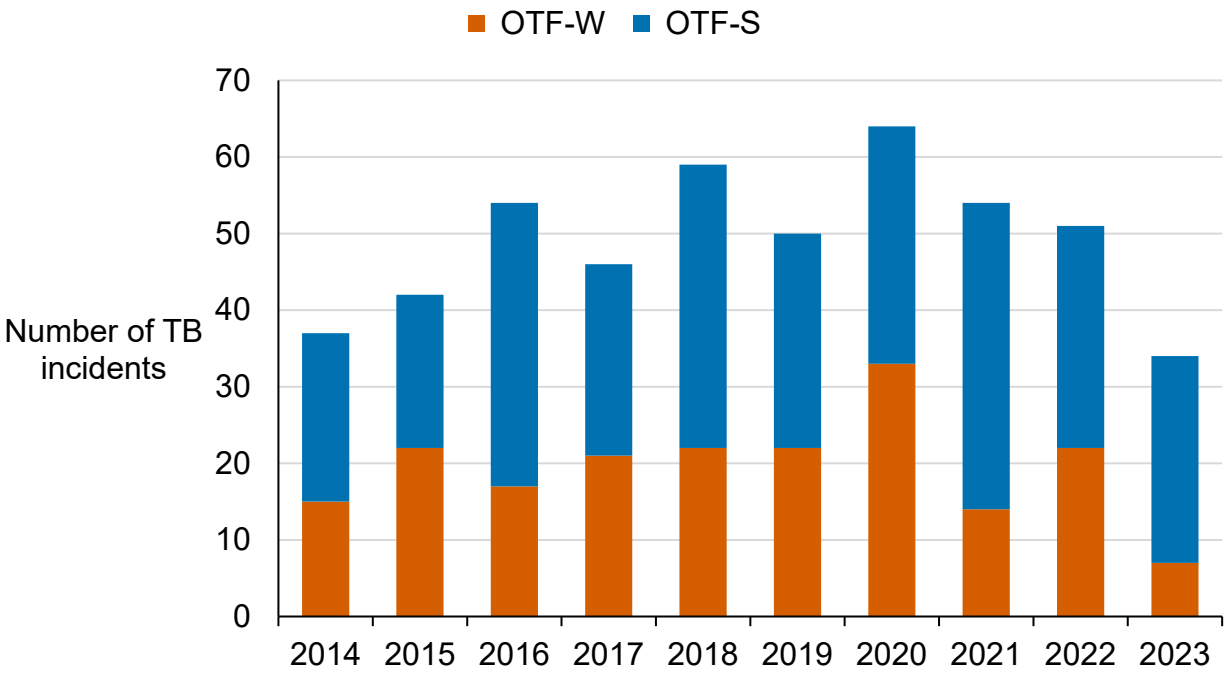

Figure 1: Annual number of new TB incidents in Leicestershire, from 2014 to 2023.

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 Leicestershire between 2014 and 2023. In 2023, there were 34 TB incidents in the whole county, 7 OTF-W and 27 OTF-S.

Disclosing test types

As shown in Figure 2, whole herd testing (WHT) detected most of the new incidents of TB (16) in 2023. This was followed by 6-monthly testing (6) and 12-monthly testing (4). The number of incidents detected by radial testing has been decreasing since 2020. The reduction in incidents detected by radial may be explained by several reasons, including:

- reduced local spread from primary incidents
- a change in classification of test types used by APHA-herds in the hotspot area of the north-east undergo more regular testing due to the higher level of disease pressure in the area. It may be that incidents were disclosed on a routine test as opposed to a reactive radial test

This highlights the importance of ongoing compliance with testing regimes.

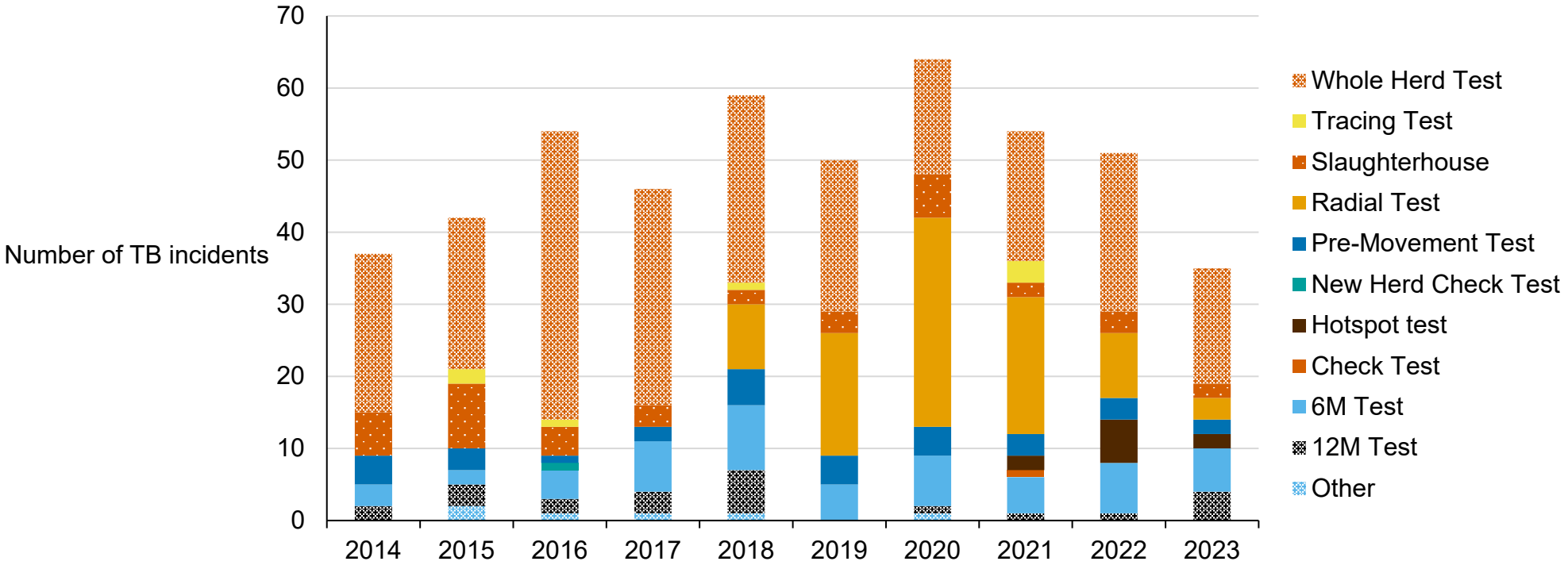

Figure 2: Number of new TB incidents (OTF-W and OTF-S) in Leicestershire in 2023, according to the surveillance methods that detected them.

Figure 2 description: A bar chart showing the number of new TB incidents disclosed by test type in Leicestershire between 2014 and 2023. In 2023, most incidents were disclosed by whole herd tests (16), followed by a 6-month post-incident test (6M test, 6), 12-monthly testing (12M, 4), radial testing (3), slaughterhouse cases (2), pre-movement tests (2), and hotspot tests (2).

Duration of TB incidents

A total of 36 TB incidents were resolved in Leicestershire during 2023. Of these, 11 were new TB incidents that started in 2023, 22 had started in 2022 and 3 in 2021.

The median duration for OTF-W incidents that ended in 2023 was 312 days, interquartile range (IQR) 175 to 449. Only one OTF-W incident took over 550 days to resolve, with all others (12 out of 13) ending in 550 days or less. One incident took less than 150 days to resolve.

Most OTF-S incidents that ended in 2023 (19 out of 22) were resolved within 206 days. Two incidents were resolved between 241 and 550 days, and one in more than 550 days. The median duration was 188 days (IQR 166 to 212).

The median duration for all incidents (both OTF-W and OTF-S) that ended in 2023 was 192.5 days (IQR 168.5 to 269). This is longer than the duration of incidents that ended in 2022; 179.5 days (IQR 159 to 267). For the whole Edge Area, the median duration of TB incidents that ended in 2023 was 188 days (IQR 159 to 265).

There were 26 TB incidents still open at the end of the reporting year on the 31st of December 2023. One OTF-W incident was considered persistent (more than 550 days under restrictions).

Unusual TB incidents

Following an OTF-W incident in 2022 on a dairy farm which lasted over a year with 94 reactors removed, a new OTF-S incident occurred in 2023 with another 20 reactors disclosed on the 6-monthly test. The most likely cause of infection is residual infection on farm from the previous breakdown though re-infection via infected wildlife cannot be ruled out. The whole genome sequencing (WGS) clade that was isolated on this farm was B6-11.

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 investigations. 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. There were no incidents of TB in other non-bovine species in Leicestershire in 2023.

Incidence of TB

In 2023, Leicestershire had an incident rate of 5.0 new incidents of TB per 100 herd-years of risk (HYR). This was lower than the Edge Area overall (7.2). Leicestershire was ranked fourth lowest for incidence out of the 11 Edge Area counties. TB incidence per 100 HYR at risk decreased in Leicestershire in 2023 (5.0) compared to 2022 (6.5), as displayed in Figure 3. This is the third year in a row that incidence has decreased in Leicestershire since 2020.

The incidence trend in Leicestershire has been mirroring the overall trend seen in the Edge Area between 2014 and 2023 in Figure 3. Incidence per 100 HYR has been increasing steadily until 2020, with a consistent decrease since. However, despite this fall, incidence in Leicestershire is still higher than 2014.

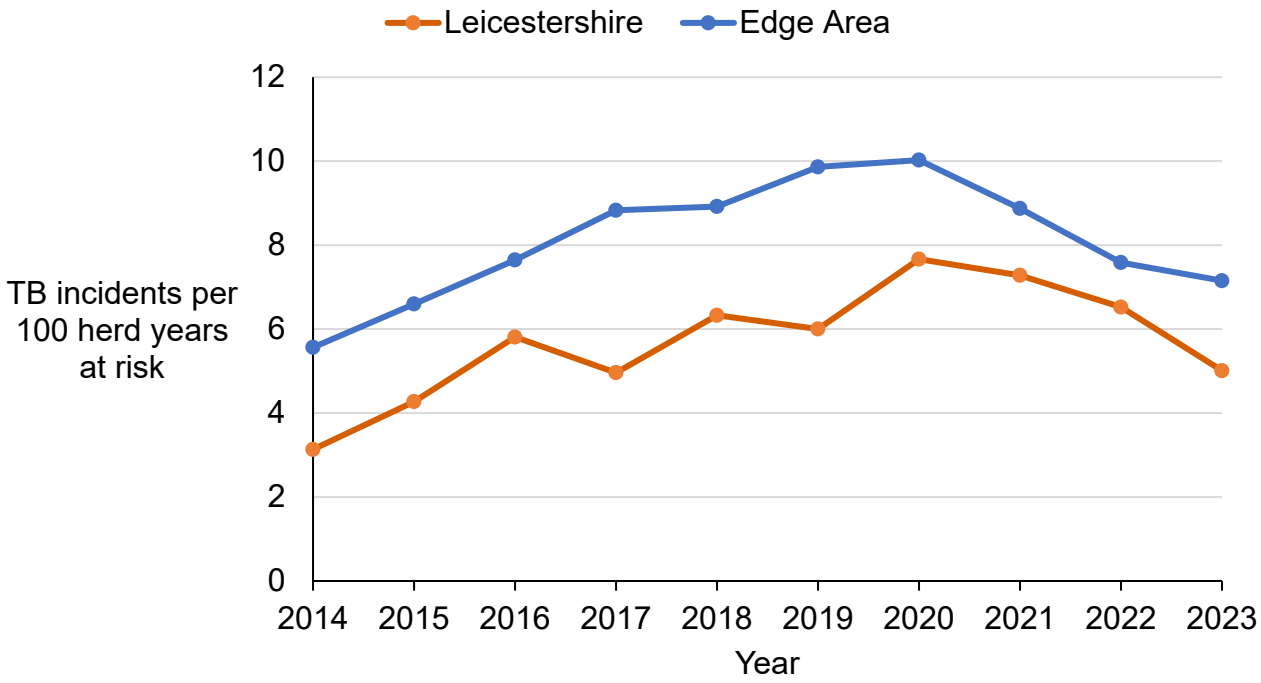

Figure 3: Annual incidence rate (per 100 herd-years at risk) for all new incidents (OTF-W and OTF-S) in Leicestershire, from 2014 to 2023.

Figure 3 description: Line chart showing the incidence rate of new TB incidents per 100 herd years at risk (100 HYR) in Leicestershire and the overall Edge area between 2014 and 2023. Incidence in Leicestershire has been declining consistently since 2020. In 2023, the incidence rate in Leicestershire was 5.0 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

Whole county herd prevalence was unchanged compared to 2022 (3.1%), as displayed in Figure 4. Leicestershire had the fifth lowest end of year prevalence out of the 11 counties in the Edge Area. This was slightly lower compared to the Edge Area overall (3.7%).

As seen for the incidence rate, the prevalence trend in Leicestershire has been largely mirroring the overall trend seen in the Edge Area between 2014 and 2023.

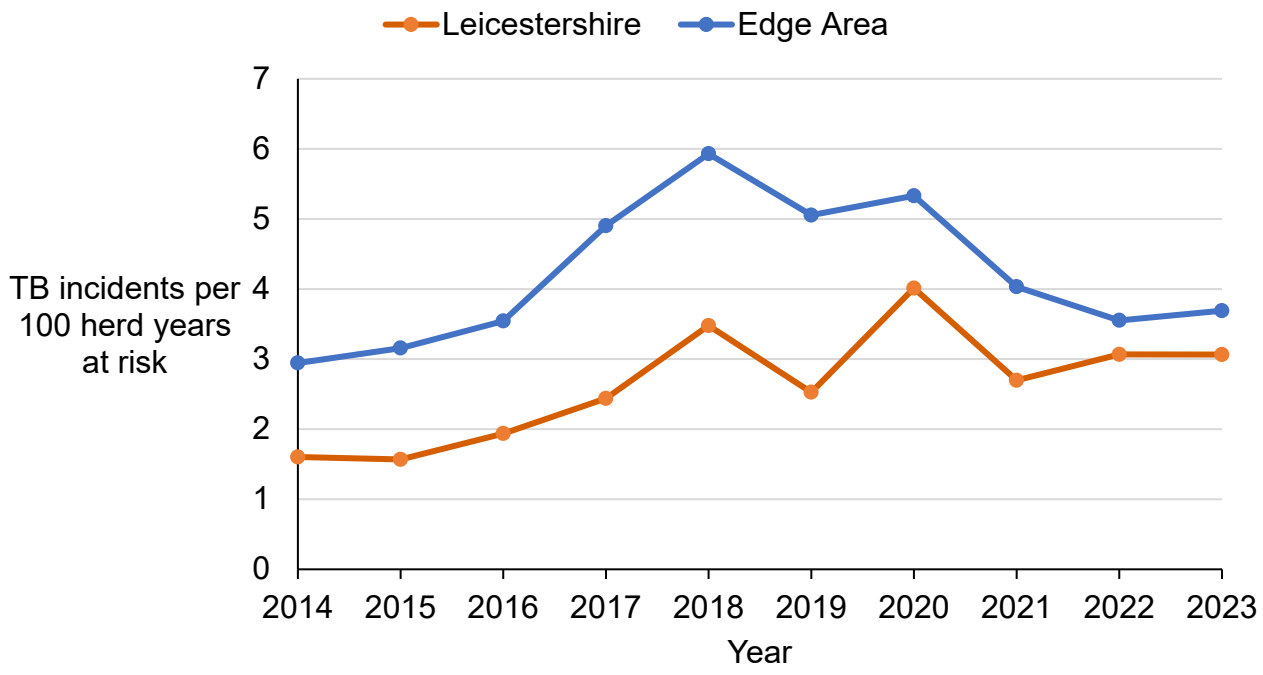

Figure 4: Annual end of year prevalence in Leicestershire, from 2014 to 2023.

Figure 4 description: Line chart showing the annual end of year prevalence in Leicestershire and within the overall Edge Area, between 2014 and 2023. Over the last 10 years, the annual end of year prevalence in Leicestershire has mirrored the trend seen in the Edge Area. In 2023, the end of year prevalence for Leicestershire was 3.1% of herds placed under TB-restrictions in the county, which was unchanged from 2022. Prevalence in the Edge Area overall in 2023 was 3.7% of herds.

Recurring TB incidents

Three-year recurrence

In Leicestershire, 18 herds (53%) with a new TB incident in 2023 had experienced another TB incident in the previous 3 years. There was a much higher proportion of OTF-W herds with a history of TB in the previous 3 years compared to OTF-S herds (86% and 44% respectively).

The recurrence rate in Leicestershire was similar to the recurrence rate of the Edge Area as a whole (54%), and fifth highest of all the Edge Area counties.

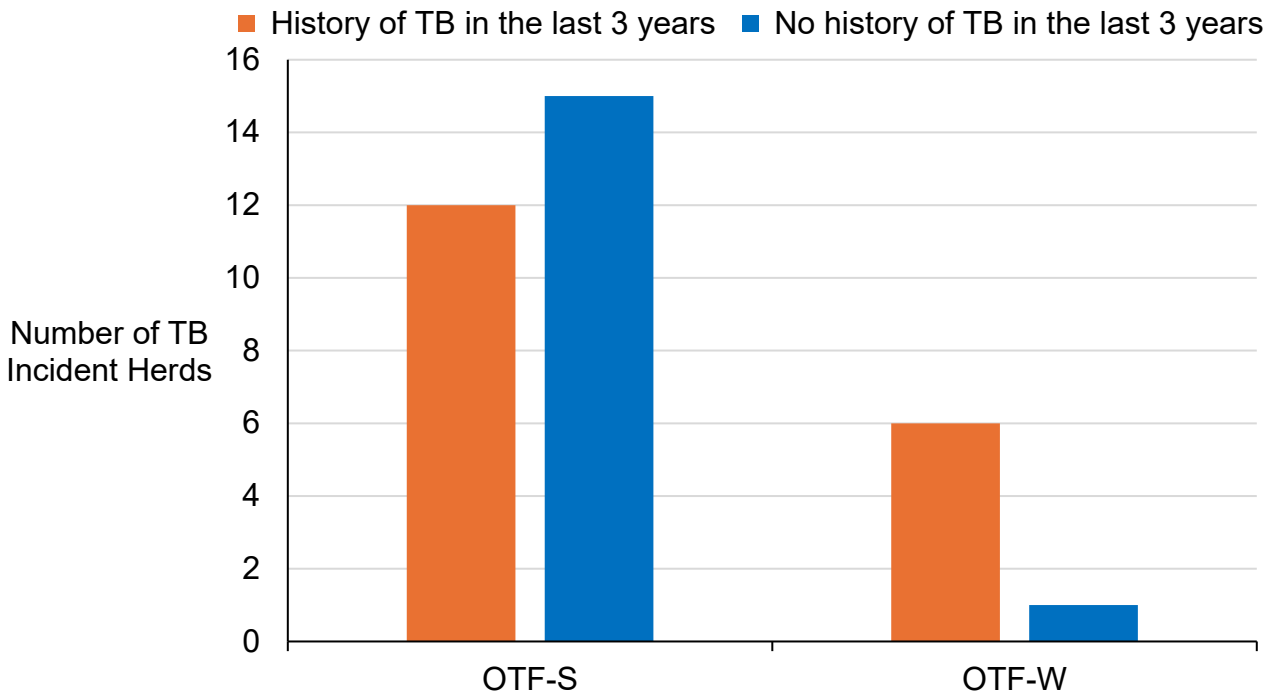

Figure 5: Number of herds with a TB incident (by OTF-W and OTF-S) in Leicestershire in 2023, with and without a history of any TB incident in the previous3 years.

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 3 years in 2023, for OTF-S and OTF-W herds. A description of the data is provided in the text.

Overall recurrence

In 2023, 86% of incidents reported on across the region were in herds with a history of TB with a history of TB in the herd's lifetime (23 out of 28 OTF-S and 7 out of 7 OTF-W), as shown in Figure 6. This includes looking back beyond the 3 year period mentioned previously.

Overall recurrence of TB increased by 46% compared to 2022 (recurrence rate of 59%, 16 out of 29 OTF-S and 14 out of 22 OTF-W).

The reason for this is unclear, however local wildlife reservoirs may be a contributing factor to the high recurrence of TB. The extension of HS23 further into Leicestershire may improve the rate of recurrence through enhanced disease controls in wildlife.

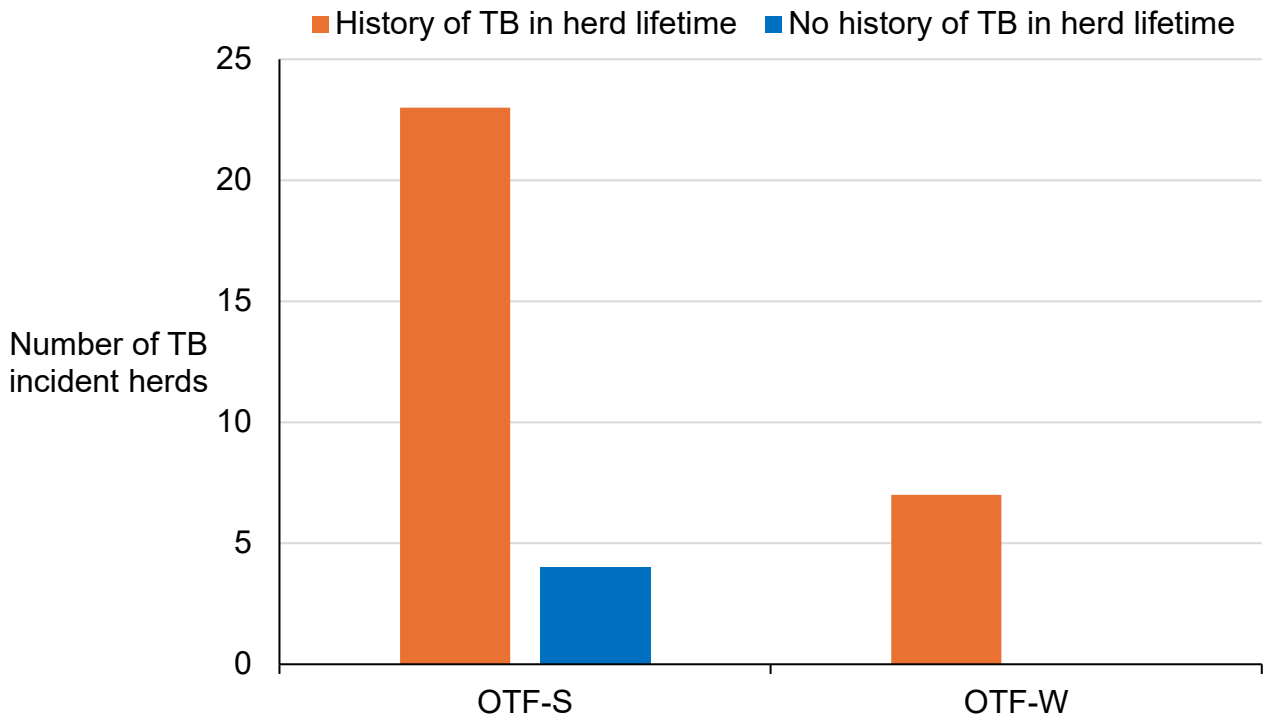

Figure 6: Number of herds with a TB incident (by OTF-W and OTF-S) in Leicestershire in 2023, with and without a history of any TB incident during the herd's lifetime.

Figure 6 description: Bar chart showing the number of herds with (in orange) and without (in blue) a history of a TB incident in 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

The geographical distribution of new TB incidents in 2023 generally mirrored the uneven density of cattle holdings across Leicestershire, with higher densities in the north and south of the county and a low density of herds across the centre. This is similar to the distribution in previous years, as shown in Figure 7.

In previous years, OTF-S incidents were mainly located in the south-west of Leicestershire, however in the last 2 years they also occurred in the north and east of the county. This could be explained by earlier detection of the disease (before visible lesions) due to enhanced testing in hotspot (HS) 23.

The WGS clades of *M. bovis* isolated from the new TB incident herds detected in 2023 were all B3-11. The incidents occurred in the north of the county, within HS23 and towards the border with Nottinghamshire. This is not unexpected as B3-11 is the clade circulating in HS23.

There was one OTF-W incident in the HS23 portion of Leicestershire in which the WGS clade was undetermined.

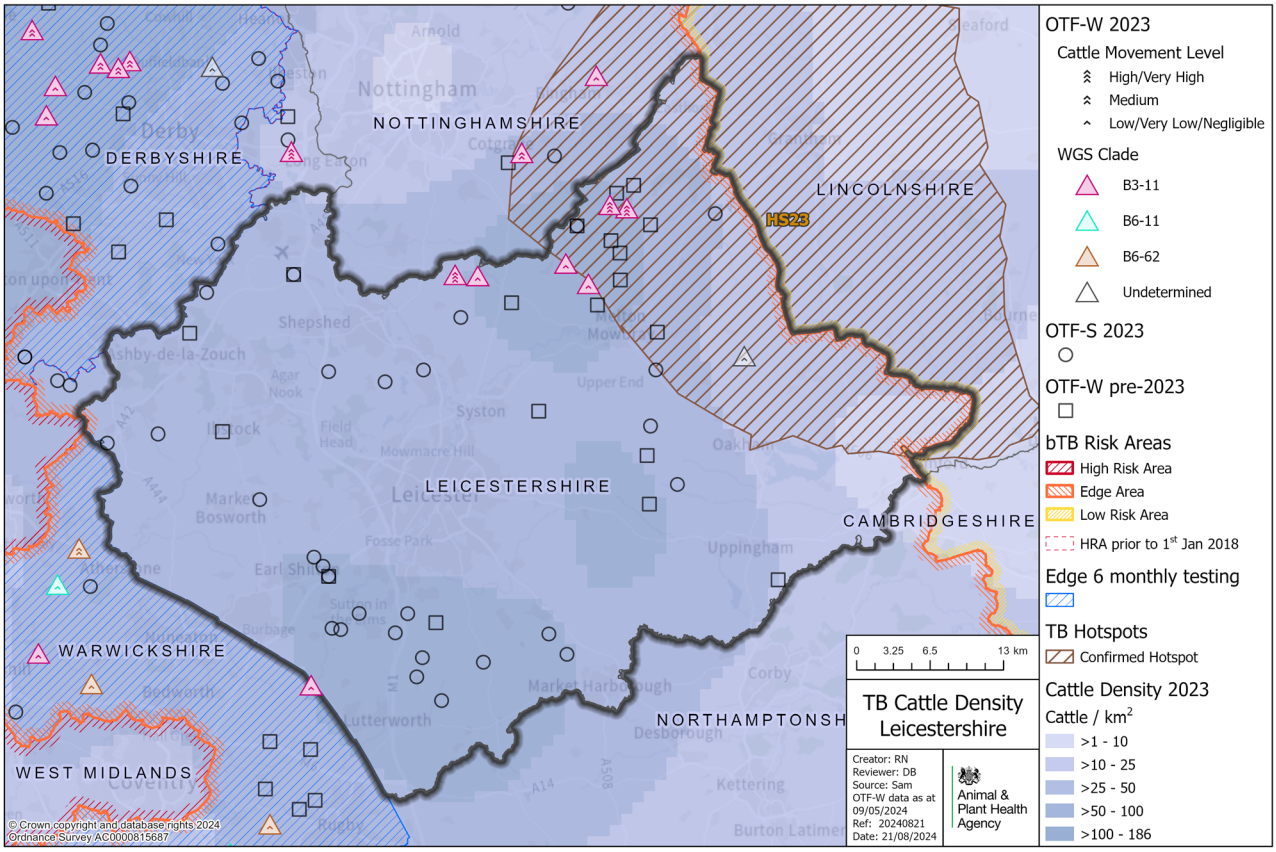

Figure 7: Location of cattle holdings in Leicestershire with new TB incidents (OTF-W and OTF-S) in 2023 and cattle holdings with pre-2023 OTF-W incidents still ongoing at the beginning of 2023, overlaid on a cattle density map. The movement score for each farm is symbolised with 3 chevrons for cattle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

Figure 7 description: Map of the Leicestershire showing the locations of cattle holdings in Leicestershire 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 or high risk of cattle movements). Most incidents occurred in the south and east of the county – further detail provided in the text.

Skin test reactors and interferon gamma test positive animals removed

In 2023, there was a total of 289 test positive animals in Leicestershire, as shown in Figure 8. This was an increase in the number of test positive animals removed from herds from 274 in 2022. While the number of interferon gamma (IFN-γ) blood test positive animals removed decreased by 12% from 131 in 2022 to 115, the number of skin test reactors increased by over a fifth (22%) from 143 in 2022 to 174.

Of the 289 test positive animals in 2023, 60% were skin test reactors and 40% were IFN-γ test positive, which was a slight increase in skin test reactors compared to 2022 (52% were skin test reactors, 48% were interferon gamma reactors).

The reduction in reactors when compared to 2021 may be linked to enhanced disease control measures taking place since 2020 within HS23.

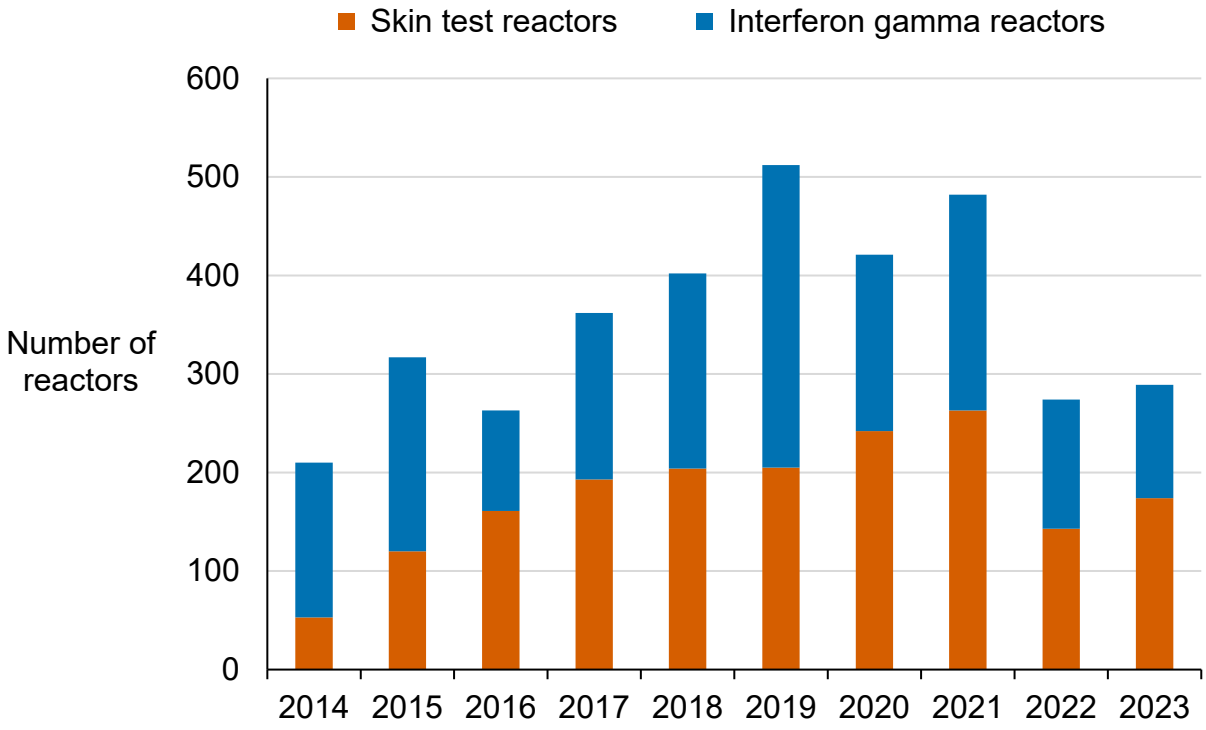

Figure 8: Number of skin test reactors (SICCT) and interferon gamma (IFN-γ) test positive cattle removed by APHA for TB control reasons in Leicestershire, from 2014 to 2023.

Figure 8 description: Bar chart showing the number of skin test reactors and interferon gamma test reactors removed for TB control reasons in Leicestershire between 2014 and 2023. In 2023, 174 skin test reactor cattle and 115 interferon gamma reactors were removed in Leicestershire.

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

In 2023, only 21 out of 34 (62%) new TB incidents in Leicestershire 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 3 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 WGS indicator of local transmission, 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 9 provides the percentage of herds where each risk pathway combination was identified. The spatial distribution of these categories are presented in Figure 10. Each category is described in greater detail in the following text.

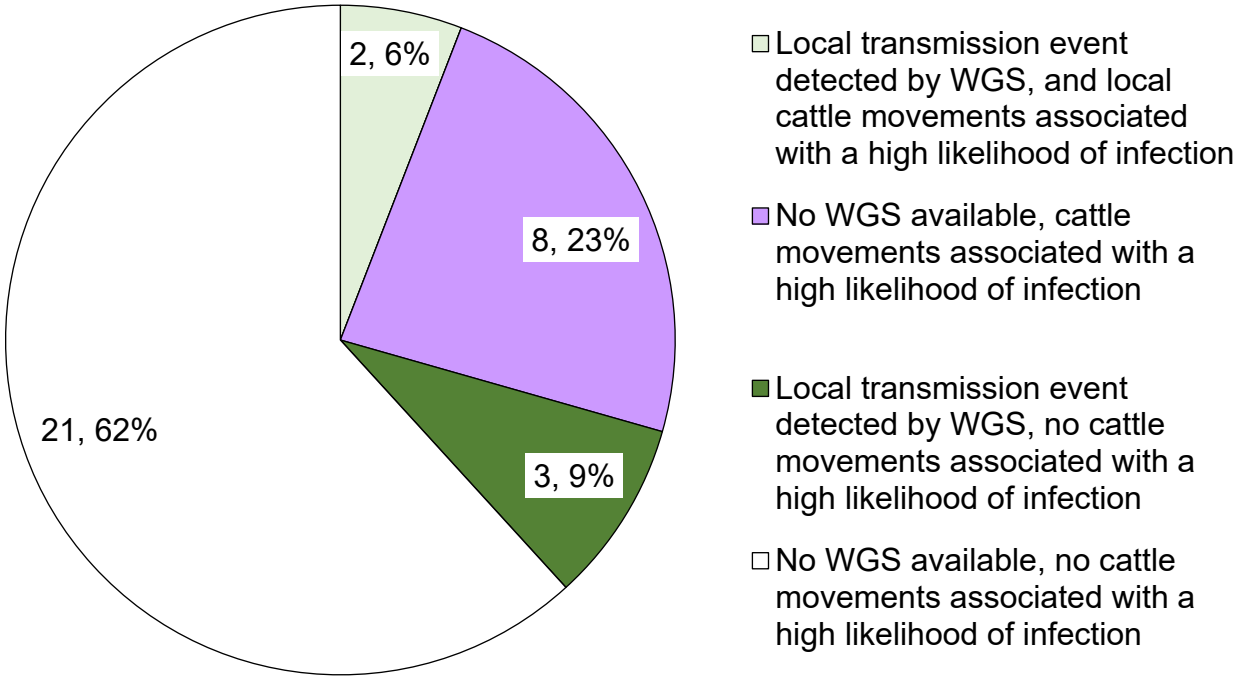

Figure 9: Risk pathway combinations identified by the WGS local transmission of infection indicator and cattle movement algorithm for 34 new TB incidents starting in Leicestershire in 2023.

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 34 new TB incidents in Leicestershire in 2023. Most (21, 62%) 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 (15%) of all new TB incidents in Leicestershire. The WGS local transmission of infection indicator identified a local transmission event for the same 5 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 (3, 9%). These are dark green symbols in Figure 10. They are clustered in the north-east near HS23.

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

A further 2 new TB incidents (6%) had evidence of both a local transmission event and local cattle movements (within 25km) that were associated with a high likelihood of TB infection. For these TB incidents, local cattle movements may have played a part in the spread of this local infection, in addition to the previously listed local pathways. These incidents are symbolised in light green in Figure 10.

In Leicestershire, 8 TB incidents (24%) had evidence of cattle movements associated with a high likelihood of TB infection, but WGS data was not available to assess local transmission events. These are depicted in light purple in Figure 10.

For a further 21 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 transmission event. These are shown as white dots in Figure 10, as there is insufficient evidence to determine a likely infection pathway.

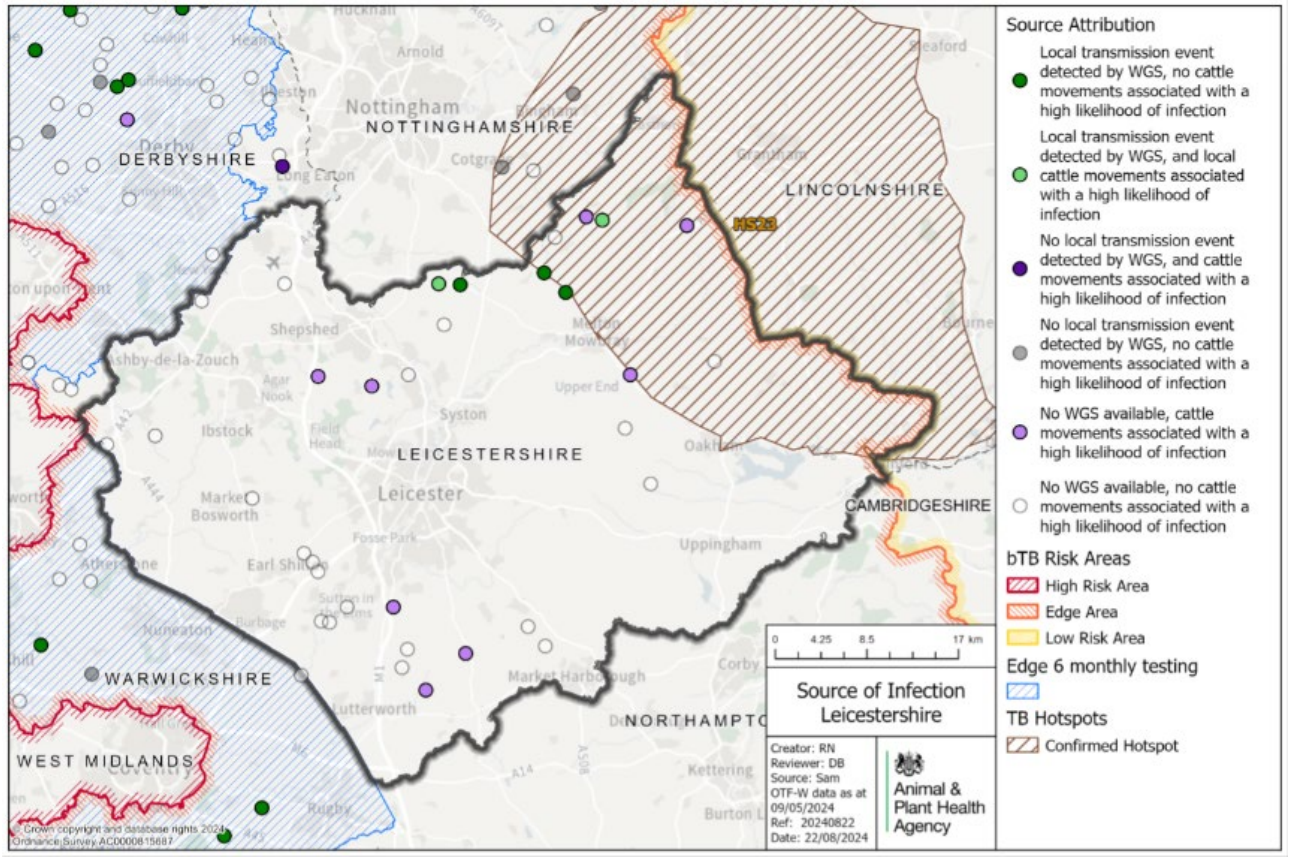

Figure 10: Map of the available evidence for risk pathways of TB infection into the herd, for all TB incidents (OTF-W and OTF-S) in Leicestershire that started in 2023.

Figure 10 description: Map of the Leicestershire county showing the locations of the 34 new TB incidents in Leicestershire, 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.

Hotspot 23

Most OTF-W incidents are found in north-east Leicestershire near Melton Mowbray. This area is covered by confirmed TB HS23, which straddles south-west Lincolnshire, north-east Leicestershire, and south-east Nottinghamshire. All incidents in this area with WGS results are caused by clade B3-11 of *M. bovis* (Figure 11).

HS23 was identified in 2018. From the evidence it was apparent that TB had become endemic in the north-east of the county (HS23) where the presence of WGS clade B3-11 was expanding across the Leicestershire border into Nottinghamshire and Lincolnshire as shown in Figure 7. The original hotspot boundary was reviewed in June 2020 and its area was extended further into Leicestershire and Lincolnshire and included part of south-east Nottinghamshire. The extended hotspot area became effective from September 2020, when culling of badgers in Leicestershire was also licensed by Natural England. The hotspot boundary will be reviewed in 2024 with a likely extension into Leicestershire while being decreased in Nottinghamshire and Lincolnshire.

Cattle and susceptible non-bovine farmed species (deer, goats, and camelids) have been subjected to enhanced TB surveillance and control measures since the inception of the hotspot. This includes wildlife monitoring through post-mortem examination and tissue sampling for *M. bovis* isolation of any deer and badger carcasses found dead in the area and reported to APHA.

In 2023, 6 dead badgers and 2 deer carcasses were reported to APHA, but none were positive for TB. This low number may be explained by licensed badger culling operations being carried out in the area since 2020 and the suspension of collections during the avian influenza season between 2022 to 2023. The public are encouraged to continue to report badger and wild deer carcasses found in this area.

Detailed data from wildlife control surveillance in HS23 are currently being consolidated in a different report and so are not presented here. Badger culling has been carried out in HS23 from 2020 to 2023. B3-11 is the only clade that has been found in badgers in HS23. The proportion of infected badgers has dropped year-on-year in the wildlife control area. Final results from 2023 will be shared in due course.

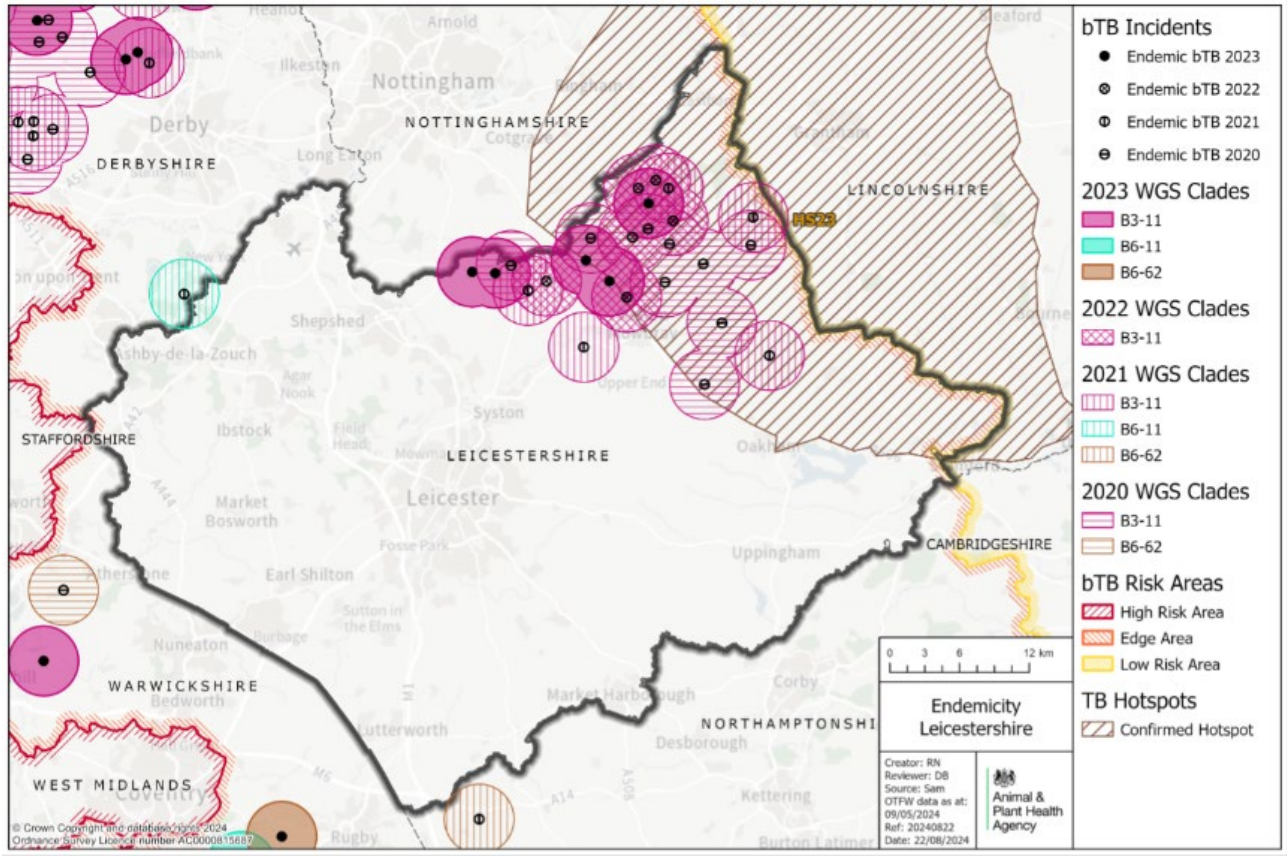

Figure 11: WGS clades of *M. bovis* detected in Leicestershire between 2020 and 2023, where the WGS identified in the infected herd was within 3 SNPs of another TB incident in the past 4 years and 9km (OTF-W incidents only).

Figure 11 description: Map of Leicestershire showing the WGS clades of *M. bovis* detected in Leicestershire 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 northeastern parts of Leicestershire. Further detail is provided in the text.

Forward look

The measures needed to address the most common risk pathways for TB infection in Leicestershire are:

- prevention of interactions between cattle and wildlife on farm to minimise spread of TB from wildlife to cattle, and cattle to wildlife
- incentivising the uptake of effective on-farm biosecurity measures by farmers, reducing the purchase of high-risk animals, and limiting nose-to-nose contacts with neighbouring herds

- continuing improving diagnostics, surveillance and epidemiology to detect and remove TB more effectively from cattle herds
- further work by APHA and stakeholders to determine the most likely risk pathways for incidents with an uncertain pathway, with the added help of the cattle movement algorithm and where possible WGS
- continuation and further adoption of measures to prevent the spread of TB from wildlife within HS23, including biosecurity, badger culling or vaccination, and local control of the wild deer population, where appropriate

Although the herd incidence of TB declined again in 2023, it is unlikely that Leicestershire will achieve OTF status by 2025.

Appendix 1: cattle industry demographics

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

Size of herds	Number of herds in Leicestershire
Undetermined	3
1 to 50	341
51 to 100	139
101 to 200	129
201 to 350	85
351 to 500	22
Greater than 500	53
Total number of herds	772
Mean herd size	139
Median herd size	64

Table 2: Number (and percentage of total) of animals by breed purpose in Leicestershire 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 Leicestershire
Beef	69,291 (64%)
Dairy	34,677 (32%)
Dual purpose	3,525 (3%)
Unknown	9 (0.008%)
Total	107,502

Appendix 2: summary of headline cattle TB statistics

Table 3: Herd-level summary statistics for TB in cattle in Leicestershire between 2021 and 2023

Herd-level statistics	2021	2022	2023
(a) Total number of cattle herds live on Sam at the end of the reporting period	941	927	893
(b) Total number of whole herd skin tests carried out at any time in the period	1,078	1,011	846
(c) Total number of OTF cattle herds having TB whole herd tests during the period for any reason	786	768	735
(d) Total number of OTF cattle herds at the end of the report period (herds not under any type of TB movement restrictions)	861	847	829
(e) Total number of cattle herds that were not under restrictions due to an ongoing TB incident at the end of the report period	913	895	863
(f.1) Total number of new OTF-S TB incidents detected in cattle herds during the report period	40	29	27
(f.2) Total number of new OTF-W TB incidents detected in cattle herds during the report period	14	22	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?	2	6	2
(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?	2	10	1

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)?	12	12	6
(g.4) Of the new OTF-W herd incidents, how many were first detected through routine slaughterhouse TB surveillance?	2	3	2
(h.1) Number of new OTF-W incidents revealed by enhanced TB surveillance (radial testing) conducted around those OTF-W herds	0	0	0
(h.2) Number of new OTF-S incidents revealed by enhanced TB surveillance (radial testing) conducted around those OTF-W herds	0	0	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)	9	15	9
(j) New confirmed (positive *M. bovis* culture) incidents in non-bovine species detected during the report period (indicate host species involved)	1 cat	0	0
(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	14	14	12
(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 Leicestershire 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)	164,066	156,393	136,146
(b.1) Reactors detected by tuberculin skin tests during the year	263	143	174
(b.2) Reactors detected by additional IFN-γ blood tests (skin-test negative or IR animals) during the year	219	131	115
(c) Reactors detected during year per incidents disclosed during year	8.9	5.4	8.3
(d) Reactors per 1,000 animal tests	2.9	1.8	2.1
(e.1) Additional animals slaughtered during the year for TB control reasons (dangerous contacts, including any first time IRs)	10	8	6
(e.2) Additional animals slaughtered during the year for TB control reasons (private slaughters)	24	22	2
(f) Slaughterhouse (SLH) cases (suspect tuberculous carcasses) reported by Food Standards Agency (FSA) during routine meat inspection	10	15	14
(g) SLH cases confirmed by *M. bovis* PCR testing or bacteriological culture	3	6	7

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 incidents reported are submitted for culture analysis. All incidents 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, 21 out of 34 (62%) new TB incidents in Leicestershire 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 is due to the continued impact and diversion of field resource 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 21 incidents with a preliminary or a final veterinary assessment in Leicestershire, in 2023

Source of infection	Possible (1)	Likely (4)	Most likely (6)	Definite (8)	Weighted contribution
Badgers	8	3	8	0	37.3%
Cattle movements	6	3	1	0	16.0%
Contiguous	0	0	0	0	0.0%
Residual cattle infection	4	0	2	0	11.6%
Domestic animals	0	0	0	0	0.0%
Non-specific reactor	0	0	1	0	4.8%
Fomites	3	3	0	0	10.1%
Other wildlife	3	2	1	0	6.8%
Other or unknown source	1	0	0	0	13.5%

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

Data Protection:
For information on how we handle personal data visit www.gov.uk and search Animal and Plant Health Agency Personal Information Charter.

This publication is available Bovine TB epidemiology and surveillance in Great Britain.

Any enquiries regarding this publication should be sent to us at the National TB Epi Mailbox.

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