

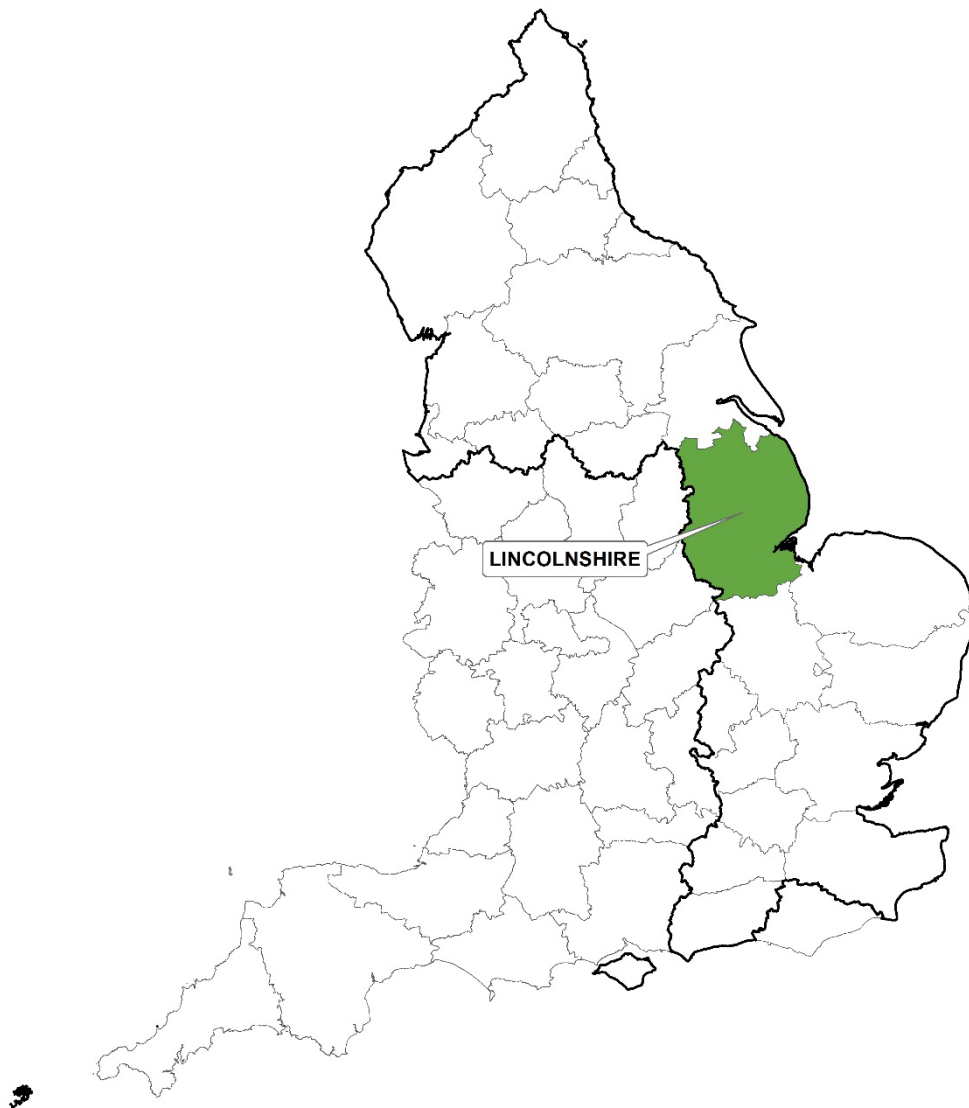


Animal &
Plant Health
Agency

Year-end descriptive epidemiology report: Bovine TB in the Low Risk Area of England County coverage: Lincolnshire

Year-end report for: 2020

TB Low Risk Area - LINCOLNSHIRE



Contents

Executive summary	1
Reporting area	1
Local cattle industry	1
New incidents of TB.....	1
Potential or confirmed TB hotspot areas	1
Unusual TB incidents.....	2
Suspected sources and risk pathways for TB infection	2
Disclosing tests	2
Reactor numbers	2
Risks to the reporting area	2
Risks posed by the reporting area	3
Forward look	3
Introduction	4
Changes due to COVID-19	4
Cattle industry	5
Herd types	5
Markets and abattoirs	5
Licensed Finishing Units	6
Common land.....	6
Descriptive epidemiology of TB	7
Temporal TB trends	7
Geographical distribution of TB incidents	8
Potential or confirmed TB hotspot areas	10
Other characteristics of TB incidents.....	13
Suspected sources, risk pathways and key drivers for TB infection.....	15

TB in other species	17
Detection of incidents	17
Skin test reactors and interferon gamma test positive animals removed	18
Summary of risks to Lincolnshire.....	19
Summary of risks from Lincolnshire to surrounding areas.....	19
Assessment of effectiveness of controls and forward look	20
Effectiveness of controls	20
Forward look	20
Appendices	21
Appendix 1: Overview of risk and surveillance areas of England and Low Risk Area objectives and controls	21
Appendix 2: Cattle industry in the reporting area.....	24
Appendix 3: Summary of headline cattle TB statistics.....	25
Appendix 4: Suspected sources of <i>M. bovis</i> infection for all of the new OTF-W and OTF-S incidents identified in the report period	28
Appendix 5: Assessment of the origin of (and potential for spread of infection from) all the new OTF-W incidents identified in the report period	30

Executive summary

Reporting area

Lincolnshire is part of the Low Risk Area (LRA) that was established in 2013. This area was later incorporated into the Government's strategy to achieve Officially Tuberculosis Free (OTF) status for England by 2038. Overall, the LRA has a very low and stable incidence of infected herds. This end of year report describes bovine TB (bTB) in the specified reporting area only.

Local cattle industry

The cattle industry in Lincolnshire is predominantly beef based. Beef farms provide an outlet for the abundance of arable crop products and by-products grown in the county. There continues to be a decline in dairy cattle numbers both in terms of farms and animals; those that remain are spread across the county.

New incidents of TB

In 2020 there was a total of 22 new TB incidents in Lincolnshire. Ten of these had at least one lesion and/or culture positive test reactor (i.e. OTF status withdrawn or OTF-W) incidents. This is an increase from the 2019 figure of six. There were 12 other incidents in which all the reactors showed no visible lesions of TB at post-mortem inspection and failed to yield *Mycobacterium bovis* (*M. bovis*) on bacteriological culture during 2020, which is twice the number disclosed in 2019.

Potential or confirmed TB hotspot areas

Confirmed Hotspot Area HS23

During 2020, two badger carcasses were found to be *M. bovis* positive on culture (genotype 25:a) in this area of the south-west of the county along the boundary with Leicestershire, which was undergoing enhanced cattle and wildlife surveillance as potential TB hotspot HS23. Whole-genome sequencing (WGS) of the *M. bovis* isolates from both badgers indicated a close genetic relationship with the local cluster of cattle incidents.

The detection of *M. bovis* in the local surveyed wildlife within the then potential hotspot area HS23, along with this genetic analysis, indicated that infected cattle herds and badgers share the same strain of *M. bovis* and that there is a credible epidemiological link between them. As a result, what had been until then a potential hotspot area became a confirmed bovine TB Hotspot on 1 August 2020.

Potential Hotspot Area HS28

A cluster of seemingly unrelated OTF-W incidents around the town of Louth, in the east of the county, were disclosed in 2019 and 2020. A review of these incidents and others in the area found that the source of disease could not reasonably be attributed to introductions of infected cattle. As a result, this area was classified as potential hotspot area HS28 in October 2020. Wildlife TB surveillance has been implemented in the designated area. To date no extra cattle testing measures have been requested over and above the existing radial TB surveillance regime around holdings with OTF-W incidents.

Unusual TB incidents

There have been no unusual TB incidents during 2020 nor any incidents of laboratory-confirmed *M. bovis* infection in non-bovines.

Suspected sources and risk pathways for TB infection

The main pathway of infection for cattle herds continues to be the movement of undetected infected cattle bringing disease in from outside Lincolnshire. In HS23, local spread remains a key pathway. There is tentative evidence of local spread in HS28.

Details of the methodology used to calculate the weighted contribution of the different suspected sources of *M. bovis* infection for all new incidents can be found in the main body of the report and in the [Explanatory Supplement](#).

Disclosing tests

In 2020 there was an increase in the numbers of radial surveillance tests carried out. Ten of the 22 incidents in 2020 were disclosed at radial tests. Routine herd testing (48 months) and post-movement testing continued to disclose reactors. All cattle herds in HS23 are now on annual testing and this test type disclosed one incident in 2020.

Reactor numbers

In total, there were 95 cattle removed from herds with TB incidents in 2020 for TB control reasons, an increase from previous years. Of these, 83 were skin test reactors and 12 were interferon gamma test (IFN- γ) positive animals disclosed in OTF-W incidents.

Risks to the reporting area

The two main risks to Lincolnshire remain the movement of infected cattle from endemic areas and encroachment of disease from north-east Leicestershire.

Risks posed by the reporting area

Lincolnshire has a shared risk with Leicestershire in HS23. There is a small amount of potential hotspot area HS28 that encroaches into Humberside, but there have been no incidents or wildlife collections reported in this area. Thus, Lincolnshire represents very low risk to the TB status of neighbouring counties.

Forward look

The current surveillance and incident management measures are keeping the incidence of TB in Lincolnshire under control and, overall, the disease incidence remains low. If robust testing is maintained alongside improvements to biosecurity and more careful sourcing of cattle, the outlook for Lincolnshire maintaining its low TB risk status is positive.

Introduction

This report describes the level of bovine tuberculosis in cattle herds in Lincolnshire in 2020. Bovine tuberculosis is caused by the bacterium *Mycobacterium bovis* (*M. bovis*) and will subsequently be referred to as TB. This report explores the spatial and temporal distribution of TB in cattle herds. It examines what is likely to be driving TB in this area, and the risks the disease in this area may pose to neighbouring cattle. Although other sources may refer to TB 'breakdown(s)', this report will use the term 'incident(s)' throughout. This report is intended for individuals involved in the control of TB, both in the local area and nationally. This includes, but is not limited to: farmers, veterinarians, policy makers and the scientific community.

In 2014 the Government published its Strategy to achieve Officially Bovine Tuberculosis 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 vary the approach to control accordingly. To this end three management areas were established (see Appendix 1). Lincolnshire forms part of the Low Risk Area (LRA). Overall, the LRA has a very low and stable incidence of infected herds. The current strategy seeks to rapidly control infection when it arises through high sensitivity testing of affected herds and temporarily enhanced local surveillance (radial and hotspot testing). Mandatory pre- and post-movement testing of cattle entering the LRA from higher risk areas of the UK is also performed to reduce the risk of TB introduction. The aim is to preserve the favourable disease status of this area so that its counties can be declared OTF as soon as possible.

Changes due to COVID-19

During 2020, public health measures adopted by the government to contain the COVID-19 outbreak impacted the ability to carry out some TB testing due to social distancing and self-isolation guidelines, affecting both veterinarians and farmers. In particular, from 23 March 2020, routine or targeted TB skin tests were not mandatory for cattle under 180 days old where, in the official veterinarian's judgement, the young stock could not be tested safely in line with social distancing guidelines. The temporary amendment allowing calves under 180 days old to be excluded from TB testing did not apply to short interval tests in TB incident herds (required to restore a herds OTF status) or pre- and post-movement testing.

Routine TB skin tests are required within a pre-defined window of time to maintain a herds OTF status. From 23 March 2020, for tests that were allocated until 30 June 2020, the Animal and Plant Health Agency (APHA) permitted an extension to the TB skin testing windows on a case-by-case basis, where testing had not been completed due to valid reasons associated with COVID-19. The testing window for short interval tests was also extended by up to 30 days, where tests were unable to be completed due to COVID-19.

Furthermore, on-farm epidemiological assessments carried out to establish the route of infection for a TB incident herd were carried out remotely, by telephone, for the majority of 2020.

Cattle industry

Herd types

On 1 January 2020 there were 78,160 cattle in 752 herds in Lincolnshire (Appendix 2). This is the second year that there has been a drop in the number of cattle (84,457 cattle on 1 January 2018 and 81,149 on 1 January 2019). This represents a 7.5% drop in cattle numbers over three years, although the total number of herds has remained stable.

Almost half of all herds are small, with between 1-50 cattle, with only 3% of herds having more than 501 cattle (Figure 1). The Lincolnshire cattle industry can be broken down (in order of total cattle) into the following four categories: finishing units (intensive and extensive systems), beef-suckler herds (pedigree and commercial herds), dairy herds, and hobbyists.

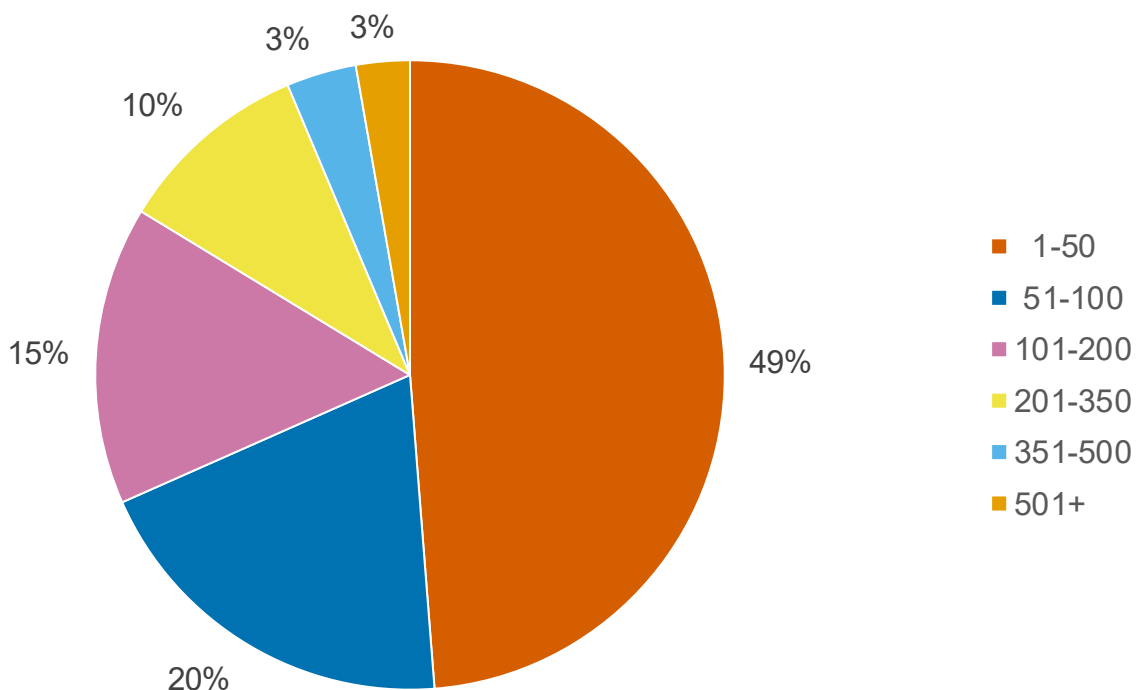


Figure 1: Proportion of cattle holdings in Lincolnshire, by herd size in 2020 (n=724). Note herds with an undetermined size are not shown.

Markets and abattoirs

There is one livestock market in the county (Louth), which operates at least one day a week. This market continues to provide an outlet for store, breeding, and fat cattle.

There are seven cattle abattoirs in the county.

Licensed Finishing Units

LFUs are a type of TB unit that can be approved by APHA in the LRA of England. They must follow a strict biosecurity and sourcing policy and are inspected annually by APHA. LFUs provide an outlet for the finishing of negative-testing cattle from multiple officially TB free (OTF) herds.

There are eight Licensed Finishing Units (LFUs) in the county, with no new units approved in 2020

Common land

There are 89 pieces of common land registered in the county. However, none were linked to any TB incidents in Lincolnshire in 2020. In the LRA, there is normally no requirement to test cattle moving to and from the commons. Grazing common land can be a high-risk strategy as cattle from multiple herds can mix freely.

Descriptive epidemiology of TB

Temporal TB trends

Unless otherwise specified, this report includes all new TB incidents detected during the reporting period. This includes 'officially tuberculosis free status withdrawn' (OTF-W) incidents and 'officially tuberculosis free status suspended' (OTF-S) incidents. OTF-W incidents are those involving one or more test reactors with typical lesions of TB identified at post-mortem, and/or one or more animals with *M. bovis*-positive culture results from tissue samples. OTF-S incidents are triggered by reactors to the Single Intradermal Comparative Cervical Tuberculin (SICCT) skin test, but without subsequent detection of lesions or positive culture results in any of those animals.

As can be seen in Figure 2, the annual total number of new incidents detected in Lincolnshire continues to increase. The number of OTF-W incidents in 2020 rose from six to ten. The number of OTF-S incidents rose from nine in 2019 to 12 in 2020. Although the number of incidents has increased, at county level, the number of incidents remains low compared to the Edge and High Risk areas. The increase in the number of new incidents could in part be due to the increase in the number of cattle tested through radial testing, a form of enhanced surveillance in the area surrounding an OTF-W incident. Ten out of the 22 incidents in 2020 were disclosed at a radial test.

In 2020, 2,300 fewer cattle were tested than in 2019, which may have been due to COVID-19 pandemic restrictions, but more skin reactors were detected (Appendix 3). More herds were subjected to whole-herd tests in 2020 than in previous years. There is no indication that TB has remained undetected on farms because fewer animals were tested.

As some incidents began before 2020 and ended after 2020, care must be taken in interpreting the total number of reactors found. An alternative way to look at temporal trends is to assess the number of reactors found per 1,000 cattle tested in 2020 only. This figure was 2.09 for 2020, an increase on the 2019 figure of 1.36. Thus, it appears that there was a true increase in the number of reactors found in 2020 compared to previous years.

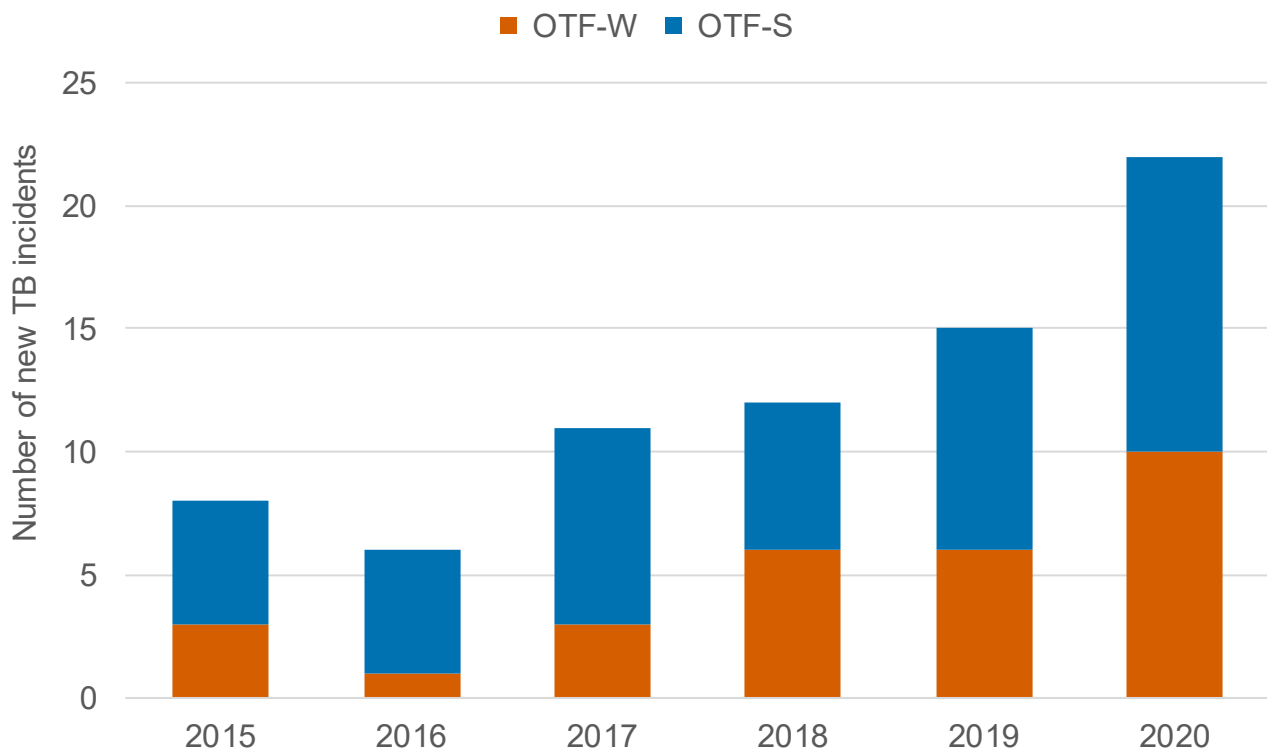


Figure 2: Annual number of new TB incidents in Lincolnshire, from 2015 to 2020.

Geographical distribution of TB incidents

As in previous years, the new incidents were spread across Lincolnshire. Figure 3 shows two notable clusters of incidents in terms of time and space. Both clusters were in areas of higher cattle density. One was in the north-east and one in the south-west of the county.

The cluster in the north-east of the county is the same area that has seen an increase in incidents over 2019 and 2020. Initial epidemiology investigation has revealed no links between these incidents except their proximity to each other. Hence, local spread cannot, at this point, be ruled out. As a result, this area is now undergoing wildlife surveillance as potential hotspot area HS28. Further investigation including whole genome sequence analysis of all *M. bovis* isolates from OTF-W incident herds and wildlife carcass collection and examination continues.

The second cluster in Figure 3, is close to the border with the Edge Area county of Leicestershire and is within HS23. Notably in 2020, the number of new incidents in this area has remained at three so disease appears to have stabilised on the Lincolnshire side.

There is one OTF-W incident that sits between these two clusters in an area of lower cattle density.

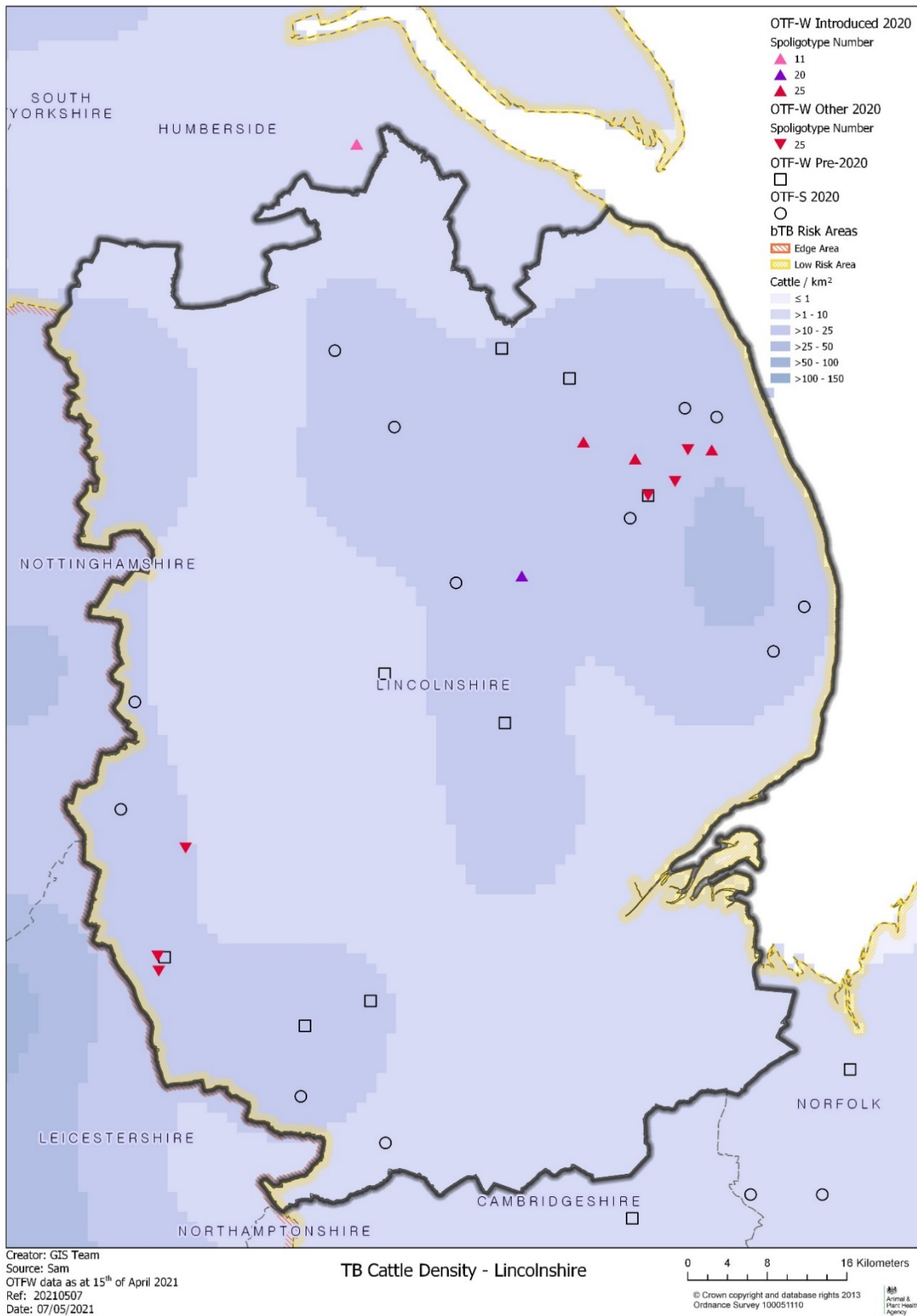


Figure 3: Location of cattle holdings in Lincolnshire with new TB incidents (OTF-W and OTF-S) in 2020, and cattle holdings with pre-2020 OTF-W incidents still ongoing at the beginning of 2020, overlaid on a cattle density map. Note: 'OTF-W Introduced 2020' refers to OTF-W incidents in which introduction of infection through cattle movements was the most likely source identified.

Potential or confirmed TB hotspot areas

Confirmed Hotspot Area HS23

TB Hotspot 23 (genotype 25:a, WGS clade B3-11) was identified in a contiguous area of west Lincolnshire and north-east Leicestershire in 2018. Cattle, and susceptible non-bovine farmed species (deer, goats, camelids) have been subject to enhanced TB surveillance and control measures since then. Wildlife have been monitored for TB by laboratory analysis of any deer and badger carcasses found dead in the area and reported to APHA.

Following the identification of *M. bovis* infection in badger carcasses, 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 (Figure 4). The extended hotspot became effective from September 2020 and the licensed control of badgers in Leicestershire and Lincolnshire started.

During 2020, 29 badgers and five deer were reported to APHA as part of TB surveillance in found-dead wildlife in HS23. Of these, 18 badgers and one deer were suitable for collection by APHA staff. Two of the badgers collected were not suitable for post-mortem examination, resulting in 16 badgers and one deer being examined. Of these, five badgers had visible lesions consistent with TB. Bacteriological culture of the lesions was undertaken with one sample being confirmed as culture positive for *M. bovis*. Further information can be found at the following location which covers a slightly longer time period:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/974351/tb-surveillance-in-wildlife-mar2021.pdf).

In 2020 there were three OTF-W and four OTF-S incidents in the Lincolnshire portion of HS23. All three OTF-W incidents were beef-suckler herds and reactors at the disclosing test were all homebred. One was a 25:b incident, which was most likely to have been caused from recurrence of infection from a 25:b incident in July 2019. The disclosing test was the six-months post-incident test, which shows the importance of continued close surveillance of these herds. The remaining two OTF-W incidents were both 25:a and were attributed to local spread: either cattle or wildlife.

Potential Hotspot Area HS28

In 2019 three contiguous incidents in the Louth area with an undetermined pathway were investigated further. One was caused by genotype 10:a of *M. bovis* and a WGS pattern previously found in Oxfordshire, but no epidemiological links between the Lincolnshire incident and Oxfordshire cluster were found. The other two incidents were both 25:a genotype but were genetically unrelated to each other. One was closely related to HS23 isolates (but no cattle have moved from there) and the other was a Cheshire strain, but again no cattle had recently moved into this herd from the homerange area. In late 2019, a further three contiguous incidents, all 25:a genotype, were disclosed a short distance from the first three incidents. As a result of five herd TB incidents of the same genotype arising in proximity over a short period and with no clear infection pathway for four of them, a Potential Hotspot Area was declared on 1 September 2020 (Figure 4).

By the end of 2020, there had been nine OTF-W incidents (the earliest from 2018) within potential hotspot area HS28. The 10:a incident was removed from analysis as the others were all 25:a. A bespoke WGS analysis was carried out on the remaining eight. The results show that two of the 2019 25:a incidents, although triggering farms for potential HS28, were unrelated to the remaining six. One 2020 incident was a beef-finisher that purchased from Edge and HRA areas, so a clear purchase incident with a whole genome sequence not closely related to the remaining five. WGS data was available for four of the remaining five incidents and the analysis showed that all were very closely related. This close relationship suggests potential local transmission between these premises and warrants further investigation. In terms of source, this cluster is most closely related to isolates from the Macclesfield / Northwich areas of Cheshire, so cattle bought from this region may have led to the original incursion.

In addition to the WGS analysis, collection of badger and deer carcasses was instigated in HS28 in September 2020. Between September and December 2020 two badgers were collected and submitted for post-mortem examination at APHA Veterinary Investigation Centres. Neither of these two badgers had visible lesions consistent with TB, but samples were taken for culture and, at the time of writing, no results were available.

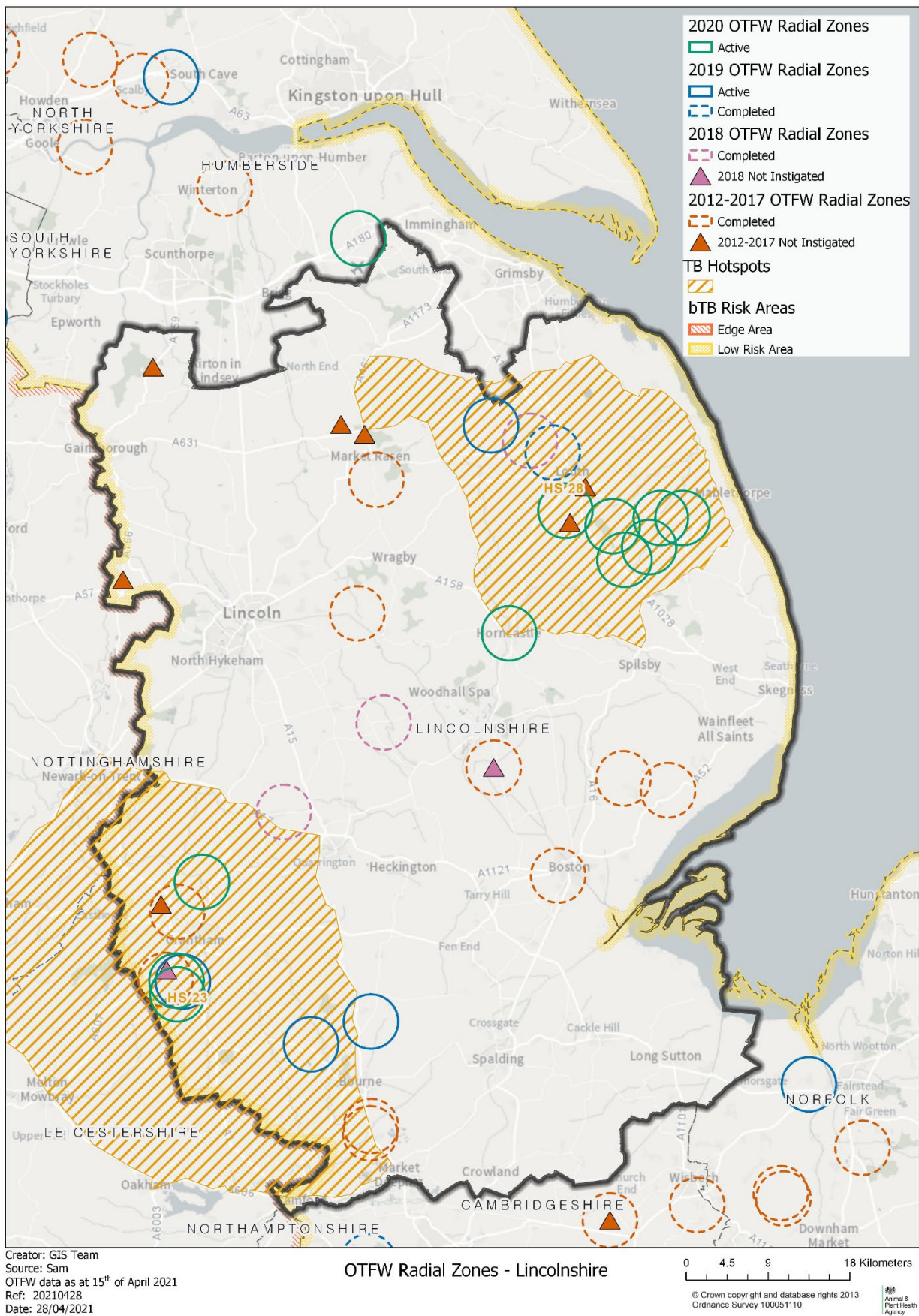


Figure 4: Hotspot and potential hotspot areas and OTF-W radial surveillance zones that were active, completed or not instigated in Lincolnshire during 2020, by year of initiation.

Other characteristics of TB incidents

Unusual TB incidents

There were no unusual TB incidents in 2020. There was one OTF-S incident in a dairy herd that made cheese from unpasteurised milk. Whilst under TB restrictions, this farm had to pasteurise their milk to minimise public health risks.

Duration of TB restrictions

Figure 5 shows the distribution of incident durations for incidents that concluded during 2020. It is worth noting that some of these incidents will have been disclosed in the previous years.

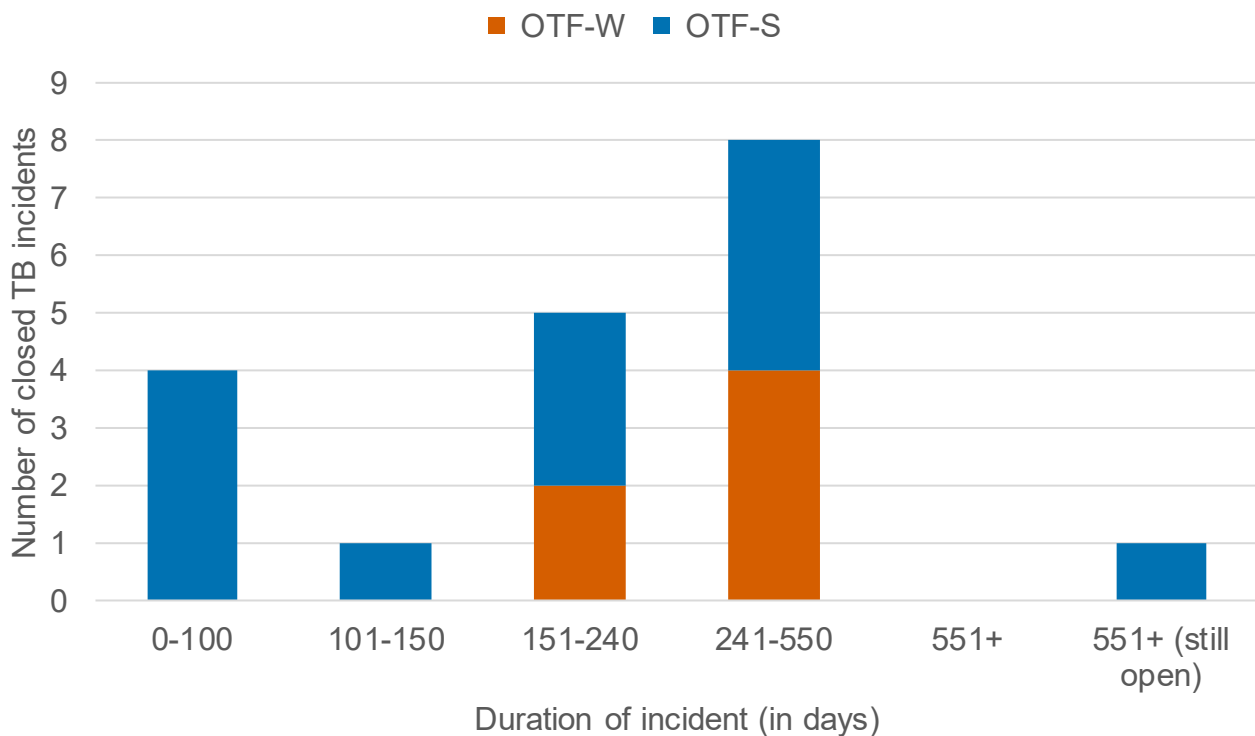


Figure 5: Duration of all TB incidents (OTF-W and OTF-S) that ended in 2020, and the number of persistent TB incidents (551+ days) that were unresolved at the end of 2020 in Lincolnshire. Note that Licensed Finishing Units (LFUs) have been excluded.

In the LRA more testing is required on OTF-W than OTF-S incidents to lift movement restrictions and regain OTF status. In 2020, the minimum testing for OTF-S incidents continued to be one Short-Interval Test (SIT) at least 60 days from reactor removal. OTF-W incidents require a minimum of two consecutive SITs with negative results and usually a supplementary IFN- γ blood test. In 2020 the median duration of OTF-W incidents was 283 days, compared with 172 days for OTF-S incidents. These numbers are approximately 50 days higher than for 2019 incidents and the most likely reason for this is due to testing delays

because of COVID-19 pandemic. The one OTF-S incidence that is 551+ and still open is due to the farmer's reluctance to test.

Genotypes associated with TB incidents

Genotyping of *M. bovis* isolates is used to trace the origin of TB infection. It is particularly useful in identifying where spread has occurred through cattle movements. Stable genotype clusters tend to be found in areas where there is a persistent local reservoir of infection. APHA implemented whole genome sequencing (WGS) in place of genotyping from April 2021. During 2020 however, genotyping was still attempted for all OTF-W herds in the (Edge Area and LRA).

The majority (eight out of ten) of OTF-W incidents in Lincolnshire in 2020 were due to infections with genotype 25:a of *M. bovis*. One farm had 25:b, which is closely related to 25:a, and so these can be considered to be one group of genetically related isolates. The remaining OTF-W incident was 20:a. As Lincolnshire is not considered to have endemic TB, all of these genotypes were classed as out-of-homerange. The homerange for 25:a and 25:b spans HS23, Staffordshire, Derbyshire, and Cheshire, whereas the homerange for 20:a is West Cornwall. The genotyping information helps to maintain Lincolnshire's low-risk status, as it shows that infection has not originated within the county.

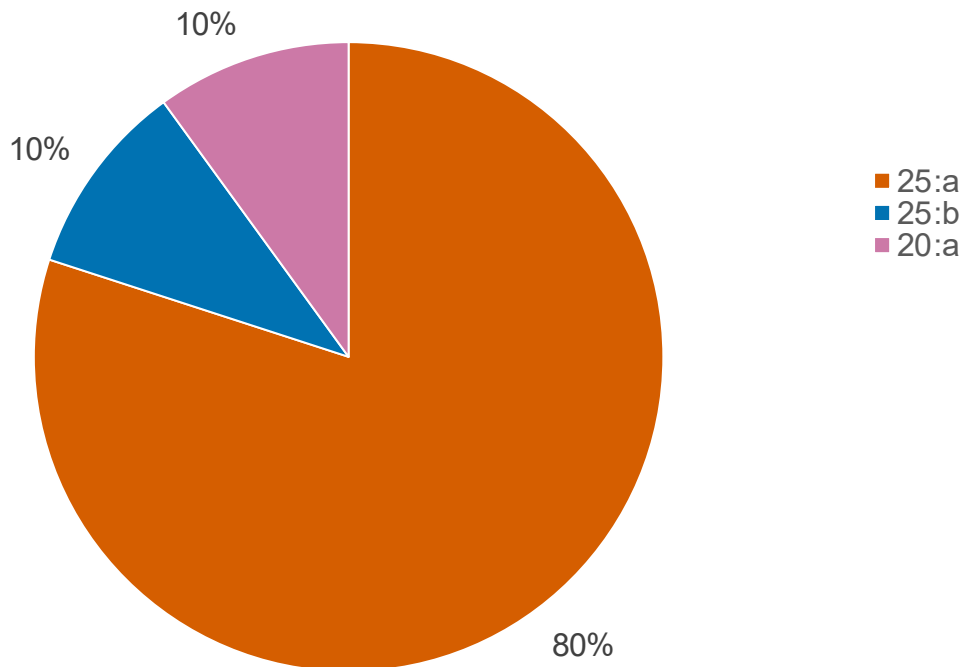


Figure 6: Genotypes of *M. bovis* identified in herds with OTF-W incidents in Lincolnshire that began in 2020 (n=10).

Suspected sources, risk pathways and key drivers for TB infection

The key drivers of the TB epidemic within the reporting area were:

- Purchasing infected animals from outside the county
- Spread between cattle and wildlife in the south-west of the county
- Potential spread between cattle and wildlife in the north-east of the county

It can be challenging to retrospectively establish the route of infection for a TB incident herd. APHA aims to complete an epidemiological assessment for all TB incidents in the LRA (both OTF-W and OTF-S). This includes a thorough on-farm investigation and scrutiny of routinely collected data, such as cattle movement records, and the results of molecular analyses where available (OTF-W incidents only).

During the APHA veterinary assessment, up to three risk pathways of infection are selected for each herd. Figure 7 shows the risk pathways identified with the highest level of certainty for OTF-W incidents only. Further details of all the risk pathways identified in both OTF-W and OTF-S incidents can be found in Appendix 4.

Figure 7 shows the results of APHA veterinary assessments of the pathways of infection for each new OTF-W TB incident detected in Lincolnshire in the year. The risk pathway with the highest likelihood score is reported in the map. Where two sources were ranked equally as the most likely source for an incident, the incident reports both pathways for that herd.

All except one of the ten OTF-W incidents were within HS23 and potential hotspot area HS28. The remaining incident in central Lincolnshire was a clear case of introduction of infection via cattle movements from the homerange of *M. bovis* genotype 20:a. At the time of writing, ongoing radial tests for this incident had not disclosed any further incidents.

Two out of the three OTF-W incidents in HS23 were attributed to wildlife and one to local cattle transmission. These pathways are consistent with findings in previous years.

Interpretation of the six incidents in potential hotspot area HS28 is more difficult at this stage, as the most likely pathways for these incidents are unclear. Unlike HS23, potential hotspot area HS28 is in its early stages of enhanced surveillance measures and more data is needed in order to draw firmer conclusions. Hence, there is a medium level of uncertainty in Figure 7. To reduce this uncertainty, more data is needed from the found-dead wildlife survey, as well as more in-depth analysis of grazing areas and their contiguity and the results of future radial tests. Table A4.1 in Appendix 4 gives a county-level picture on the most likely risk pathways; purchased cattle still represent the most common pathway.

OTF-S incidents are generally more difficult to ascribe a definitive source to. As a result, all OTF-S incidents from 2020 are undetermined. Possible sources to these unconfirmed incidents are still reported in the DRFs and are shown in Appendix 4.

TB in other species

There were no reports of TB in other farmed or captive species during 2020.

Detection of incidents

Seven out of the ten OTF-W incidents in 2020, were detected on radial surveillance testing, one on post-movement testing, one on post-incident six-month testing and one on the newly created annual testing in the LRA part of HS23 (Figure 8). This shows that the current policies of radial and post-movement testing are key to disclosing disease in the LRA.

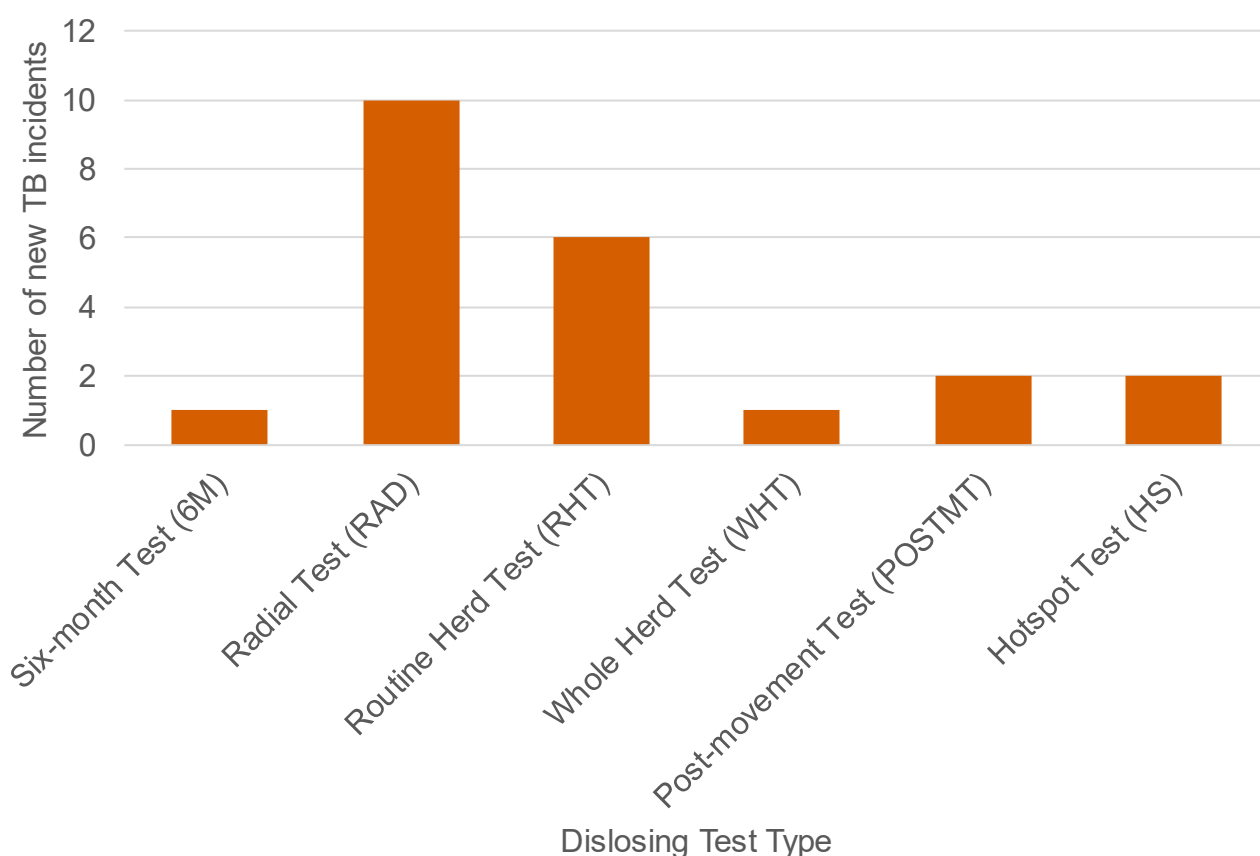


Figure 8: Number of TB incidents (OTF-W and OTF-S) in Lincolnshire in 2020, disclosed by different surveillance methods.

Skin test reactors and interferon gamma test positive animals removed

In addition to looking at the duration of incidents (see Figure 5 and associated text), it is also important to look at the number of animals removed for TB control purposes. The burden of TB in Lincolnshire to the taxpayer is low in terms of the number of incidents and the number of cattle slaughtered. State money is predominantly spent on TB testing and compensation for reactors. The annual number of cattle slaughtered for TB purposes is shown in Figure 9. In 2020, APHA removed 83 skin reactors and 12 IFN- γ test positive cattle. The IFN- γ test has a higher sensitivity and lower specificity than the comparative skin test and so is likely to disclose more TB positive animals than the skin test, often at an earlier stage of infection; this seeks to reduce the duration of an incident and minimise spread.

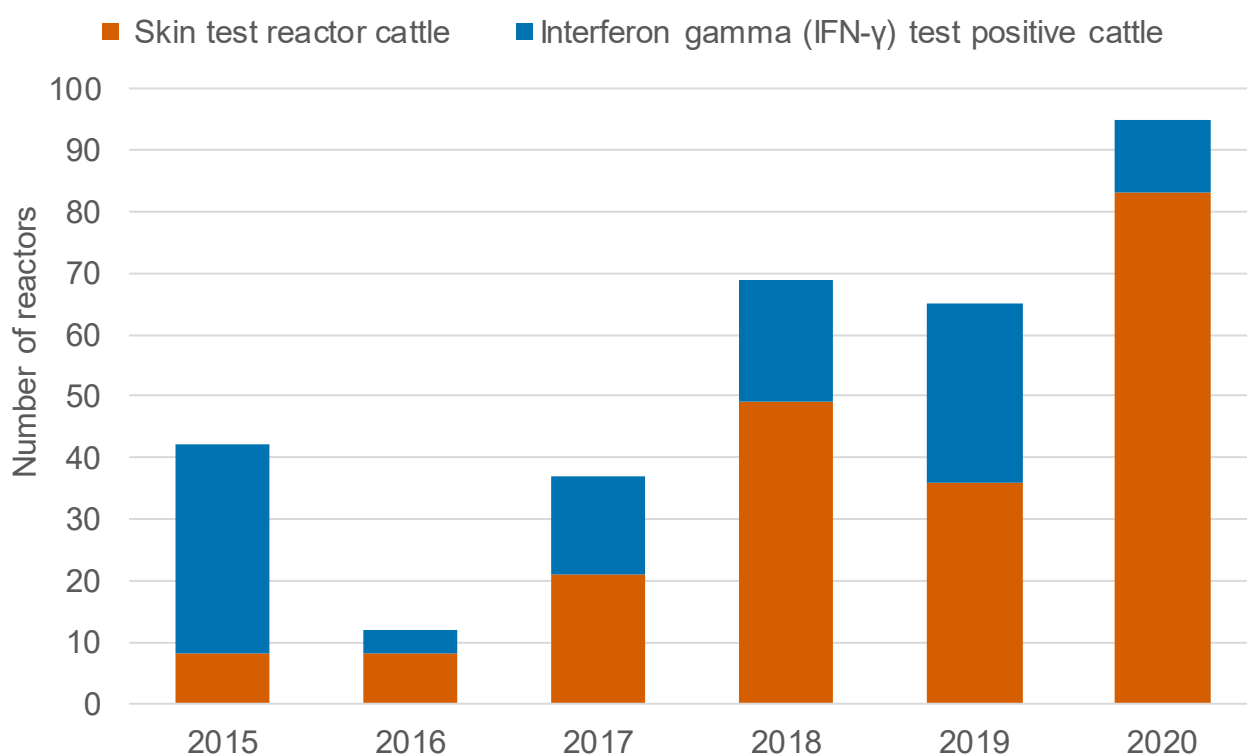


Figure 9: Number of skin test reactors and interferon gamma (IFN- γ) test positive cattle removed by APHA for TB control reasons in Lincolnshire, 2015 to 2020.

The burden to the individual farmer of TB controls is variable. The effect of movement restrictions on cattle herds varies depending on the type of business. Stock is usually moved on to finish or for breeding purposes and the main impact of a TB incident are the restrictions to move cattle off the premises. However, as many of the affected farmers in Lincolnshire are finishing units who sell cattle direct to slaughter, the overall impact of movement restrictions may be small. For smaller herds relying on sales of store cattle, movement restrictions can prove more problematic. Cattle movements off TB restricted farms in Lincolnshire during

2020 were through Approved Finishing Units (AFUs) in the Edge Area and HRA, or through approved market sales for TB-restricted cattle, of which Melton Mowbray in Leicestershire was the closest.

The number of reactors in an incident provides an overall picture of the TB status of the herd and surrounding area. Table A3.2 (See Appendix 3) presents the number of reactors per incident for all incidents (OTF-W and OTF-S). The average figure for 2020 is 4.32, which represents no change from 2019. Thus, intra-herd spread of TB in Lincolnshire continues to be stable and low.

Summary of risks to Lincolnshire

There are two main risks to spread into and within Lincolnshire:

- Risky trading practices: buying in cattle from higher risk areas of the country that could introduce disease.
- Local spread from the HS23 adjoining Edge Area in north-east Leicestershire, where there is a level of endemic TB. There are no concerns of lateral spread from other neighbouring counties.

Summary of risks from Lincolnshire to surrounding areas

Lincolnshire has a shared risk with Leicestershire in HS23. There is a small amount of potential hotspot area HS28 that encroaches into Humberside, but there have been no incidents or wildlife collections reported in this area. Thus, Lincolnshire represents very low risk to the TB status of neighbouring counties.

Assessment of effectiveness of controls and forward look

Effectiveness of controls

The current surveillance and incident management measures are keeping the incidence of TB in Lincolnshire under control and overall, the disease incidence remains low. There is suspicion of local spread within HS23. Testing in addition to routine surveillance (predominantly post-movement and radial testing) is helping to detect infected herds before they develop into substantial incidents.

Forward look

If this testing is maintained alongside improvements to biosecurity and encouragement to farmers to adopt more responsible cattle sourcing practices, the outlook remains positive for Lincolnshire maintaining its low TB risk status.

Appendices

Appendix 1: Overview of risk and surveillance areas of England and Low Risk Area objectives and controls

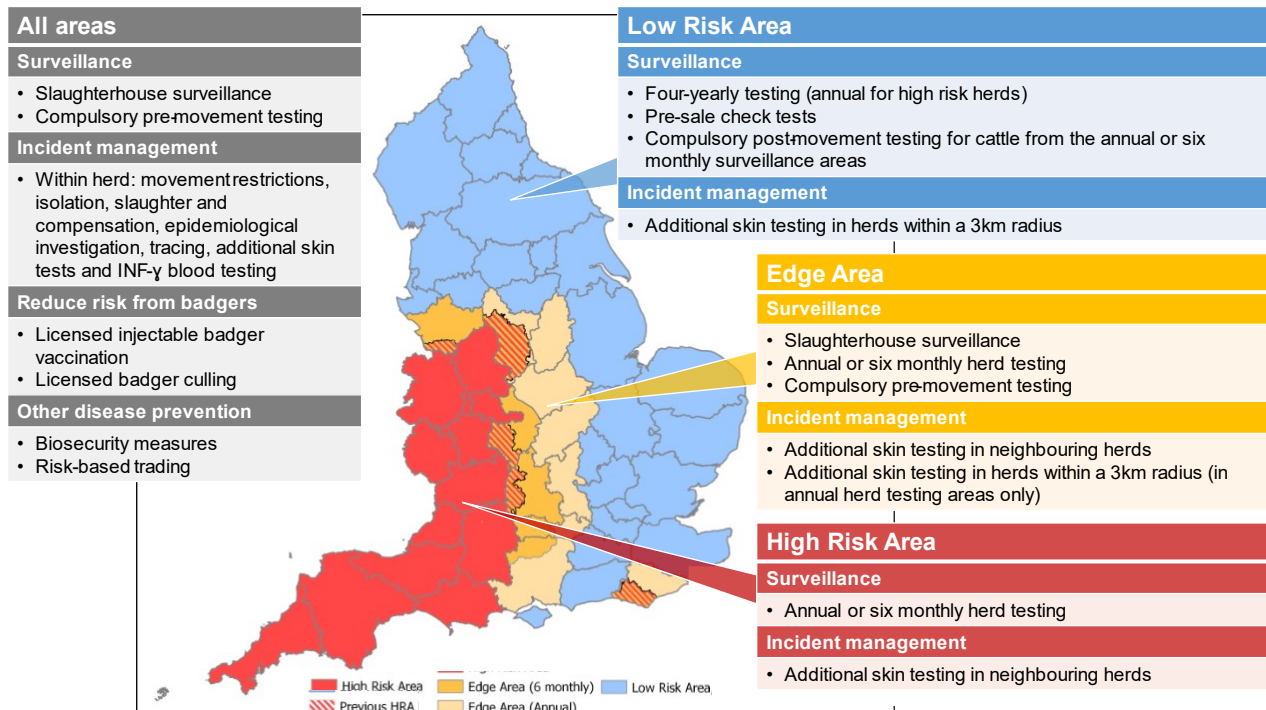


Figure A1 TB risk and surveillance areas of England effective since January 2018, as set out in the Government’s Strategy for Achieving Officially Tuberculosis-Free Status for England. Map based on information published on www.tbhub.co.uk.

Policy objectives for the LRA

Progressive attainment of OTF status for individual counties (or groups of counties) within the current LRA, with the declaration of OTF status for all LRA counties by 2025. For more information about the government’s strategy for achieving Officially Bovine Tuberculosis Free status for England, published in 2014 and independently reviewed in 2018, see:

<https://www.gov.uk/government/publications/a-strategy-for-achieving-officially-bovine-tuberculosis-free-status-for-england>

<https://www.gov.uk/government/news/government-sets-out-next-phase-of-strategy-to-combat-bovine-tuberculosis>

Key Control Measures in the Low Risk Area

Surveillance:

- default four-yearly routine surveillance (skin) testing of cattle herds, with annual testing for a small proportion of high-risk herds
- voluntary pre-sale skin check tests
- compulsory pre- and post-movement testing for cattle entering farms in the LRA (to live) from the annual or six-monthly surveillance areas of England and Wales
- additional targeted surveillance (radial testing) of cattle herds located within a 3km radius of new incident herds with OTF status withdrawn (OTF-W) following the detection of lesion-positive test reactors and/or culture-positive animals
- slaughterhouse (SLH) surveillance (through PM meat inspection) of all cattle slaughtered for human consumption

Management of incidents:

- herd movement restrictions, isolation and rapid slaughter of TB test reactors and any direct contacts with statutory compensation payments to farmers, epidemiological investigation, tracing tests (at severe interpretation), and short interval skin testing supplemented in all herds affected by OTF-W incidents with mandatory interferon gamma (IFN- γ) blood testing

TB controls in the wildlife reservoir (badgers):

- licensed injectable badger vaccination
- licensed badger culling in exceptional circumstances, where *M. bovis* infection has been confirmed in badgers and it has a clear epidemiologically link with a local cluster of TB in cattle (e.g. East Cumbria TB hotspot)

Other measures:

- biosecurity measures
- promotion of responsible sourcing of cattle (e.g. through the use of the ibTB online (www.ibtb.co.uk) mapping application)

Summary of enhanced TB control measures in this reporting area

There was strengthened collaboration between APHA and Local Authorities during 2020, which resulted in improved monitoring and enforcement of post-movement testing. Local Authorities have been adopting a more proactive role in communications with farmers and APHA has kept Local Authorities abreast of TB control policy changes. There continues to be good dialogue between APHA and stakeholders such as NFU and local farmer groups. In 2020 there were several ad hoc online farmers meetings, some of which were attended by APHA staff.

During 2020 there were no changes in routine surveillance testing intervals for specific herds or parishes in Lincolnshire. There was one exemption granted from mandatory IFN- γ herd testing in an OTF-W incident. The pathway for this incident was through the

introduction of infection via cattle movements. None of the at-risk cattle were grazed and all went straight to slaughter with no breeding on the farm.

Auditing of TB testers continued in collaboration with Veterinary Delivery Partners, although the COVID-19 pandemic reduced the number of audits carried out.

All incidents in Lincolnshire received a bespoke disease investigation from an APHA veterinarian, which in 2020 were carried out remotely. These remote investigations enabled APHA to gather information about the affected farm to establish the likely source and potential spread of disease. They also represented a good opportunity to provide advice and guidance on biosecurity, herd management risk practices and careful sourcing of cattle to the affected farmers.

Appendix 2: Cattle industry in the reporting area

Table A2.1 Number of cattle premises by size band in each county at 1 January 2020.
(RADAR data)

Size of herds	Un*	1-50	51-100	101-200	201-350	351-500	501+	Total number of herds	Mean herd size	Median herd size
Number of herds	5	353	142	111	72	26	20	729	107	52

*The number of herds with an undetermined size.

Table A2.2 Number of animals by breed purpose in each county at 1 January 2020.

Breed purpose	Beef	Dairy	Dual purpose	Unknown	Total
Number of cattle	65,499 (83%)	11,350 (14%)	1,306 (1%)	5 (<0.01%)	78,160

Appendix 3: Summary of headline cattle TB statistics

Table A3.1 Herd-level summary statistics for TB in cattle in 2020.

Herd-level statistics	2018	2019	2020
(a) Total number of cattle herds live on Sam at the end of the reporting period	924	923	921
(b) Total number of cattle herds subject to annual TB testing (or more frequent) at the end of the reporting period (any reason)	102	144	197
(c) Total number of whole herd skin tests carried out at any time in the period	280	328	337
(d) Total number of OTF cattle herds having TB whole herd tests during the period for any reason	241	254	271
(e) Total number of OTF cattle herds at the end of the report period (i.e. herds not under any type of TB2 restrictions)	890	881	867
(f) Total number of cattle herds that were not under restrictions due to an ongoing TB incident at the end of the report period.	916	910	904
(g) Total number of new TB incidents detected in cattle herds during the report period	12	15	22
• OTF status suspended (OTF-S)	6	9	12
• OTF status withdrawn (OTF-W)	6	6	10
(h) Of the new OTF-W herd incidents, how many:			
• occurred in a holding affected by another OTF-W incident in the previous three years?	-	5	1
• could be considered secondary to a primary incident based on current evidence?	-	1	1

Herd-level statistics	2018	2019	2020
<ul style="list-style-type: none"> • were triggered by skin test reactors or 2xIRs at routine herd tests? 	-	5	0
<ul style="list-style-type: none"> • were triggered by skin test reactors or 2xIRs at other TB test types (forward and back-tracings, contiguous, check tests, post-movement, etc.)? 	-	0	10
<ul style="list-style-type: none"> • were first detected through routine slaughterhouse TB surveillance? 	1	0	0
(i) Number of new incidents revealed by enhanced TB surveillance (radial testing) conducted around those OTF-W herds			
<ul style="list-style-type: none"> • OTF-S 	2	4	4
<ul style="list-style-type: none"> • OTF-W 	2	3	6
(j) 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)	5	5	9
(k) Number of OTF-W herds still open at the end of the period that are within a finishing unit	1	1	1
(l) 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

Table A3.2 Animal-level summary statistics for TB in cattle in 2020.

Animal-level statistics (cattle)	2018	2019	2020
(a) Total number of cattle tested in the period (animal tests, blood, and skin)	37,130	47,697	45,374
(b) Reactors detected in tests during the year:			
• tuberculin skin test	49	36	83
• additional IFN- γ blood test reactors (skin-test negative or IR animals)	20	29	12
(c) Reactors detected during year per incidents disclosed during year	5.75	4.33	4.32
(d) Reactors per 1000 animal tests	1.86	1.36	2.09
(e) Additional animals identified for slaughter for TB control reasons (DCs, including any first-time IRs)			
• DCs, including any first-time IRs	1	12	1
• Private slaughters	1	5	6
(f) SLH cases (tuberculous carcasses) reported by the Food Standards Agency (FSA) during routine meat inspection.	4	3	1
(g) SLH cases confirmed by culture of <i>M. bovis</i>	1	0	0

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 here.

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

Each TB incident could have up to three 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) or possible (score 1). The source(s) 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 six, then the score is made up to six using the 'Other/Unknown Source' option. Buffering up to six in this way helps to reflect the uncertainty in assessments where only 'likely' or 'possible' sources are identified.

Table A4.1 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). Genotyping of *M. bovis* isolates can be a powerful tool in identifying a likely source of infection, however genotypes 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 to the 2020 bovine TB epidemiology report for England (<https://www.gov.uk/government/publications/bovine-tb-epidemiology-and-surveillance-in-great-britain-2020>).

Table A4.1 Suspected sources of *M. bovis* infection for all the new OTF-W and OTF-S incidents identified in 2020.

Source of infection	Possible (1)	Likely (4)	Most likely (6)	Definite (8)	Weighted contribution
Badgers	8	1	2	0	14.8%
Cattle Movements	8	2	3	2	30.0%
Contiguous	4	2	0	0	7.3%
Residual Infection	0	0	2	0	8.0%
Domestic Animals	0	0	0	0	0.0%
Non-specific Reactor	1	1	1	0	8.3%
Fomites	0	0	0	0	0.0%
Other Wildlife	4	0	0	0	2.7%
Other or Unknown Source	3	0	2	0	29.0%

Please note that each TB incident could have up to three potential pathways so totals may not equate to the number of actual incidents that have occurred. Details of the methodology used to calculate the weighted contribution of the different suspected sources of *M. bovis* infection for all new incidents can be found in the main body of the report and in the Explanatory Supplement for England 2020

(<https://www.gov.uk/government/publications/bovine-tb-epidemiology-and-surveillance-in-great-britain-2020>).

Appendix 5: Assessment of the origin of (and potential for spread of infection from) all the new OTF-W incidents identified in the report period

A risk matrix was used to identify isolated incidents that were likely to have been introduced to the LRA by cattle movements, while not causing any onward local spread. The following two questions were considered for each incident, and a score attributed. TB incidents with a score of 1A, 1B or 2A may be removed from the county TB incidence calculations during an application for OTF status (but remain in the incidence calculations in this report).

What is the probability of *M. bovis* infection being introduced to the LRA via infected cattle movements?

1. Definite - for example, traced reactors found in the LRA OTF-W incident herd in question as a result of spread tracings from another TB incident herd, genotype/WGS linked.
2. Likely - for example, a Reactor or IR originated from a previous incident herd (and the genotype does not suggest otherwise), other cattle were moved into the herd from previous incident herd (but were subsequently slaughtered without testing), or the trading practice of herd provides likely evidence (purchasing large numbers of cattle from High Risk Area (HRA), or Edge Area, High and Intermediate TB areas of Wales, or from the island of Ireland).
3. Possible - not a closed herd, but cattle are purchased from the LRA, Scotland and/or EU Member States.
4. Not likely - indigenous infection is known in the locality, closed herd, genotype/WGS has been identified in local wildlife.

What is the probability of this being an isolated, sporadic ('one-off') incident, without secondary local spread from the index case?

- A. Likely - no secondary incidents have been detected. There are no further incidents as a result of spread tracings anywhere and no genotype/WGS linked OTF-W incidents within 3km radial zone around the LRA OTF-W incident herd in question (or the 3km radial surveillance zone was not triggered).
- B. Possible - no secondary incidents have been detected, but the dataset is incomplete. For example, incidents have occurred in the 3km radial zone, but only OTF-S ones, or, if OTF-W, they were of an unknown/different genotype.
- C. Not likely - secondary spread from the index case, or exposure to a common wildlife source has occurred. For example, OTF-W incidents have occurred in the 3km zone linked by genotype or WGS, or there is known wildlife infection in the area with this genotype/close WGS.

Table A5.1 Risk matrix of the veterinary assessment of the origin of, and potential for spread of infection from, all the new OTF-W incidents identified in 2020.

	Probability of isolated, sporadic ('one-off') incident, without secondary local spread from the index case (A, B, C)		
Probability of <i>M. bovis</i> infection introduced through cattle movements (1, 2, 3, 4)	A. Likely	B. Possible	C. Not likely
1. Definite		2	
2. Likely			1
3. Possible			
4. Not likely			7



© Crown copyright 2021

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

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 at www.gov.uk/government/publications

Any enquiries regarding this publication should be sent to us at

National.TBEpi@apha.gov.uk

www.gov.uk/apha

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.