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

Delivery Area: North
County: Northamptonshire
Year-end report for 2017
Table of Contents

1. Executive Summary ........................................................................................................ 3
2. Introduction ..................................................................................................................... 4
3. Cattle industry in the Edge Area of Northern region, Northamptonshire ......................... 5
4. Overview of the TB epidemic in Northamptonshire .......................................................... 6
   a. History of TB in the county ......................................................................................... 6
   b. Geographical distribution of bovine TB cases (new and ongoing) in Northamptonshire .................................................. 6
5. Descriptive epidemiology of bovine TB in the Edge Area of Northern Region, Northamptonshire .............................................................................................................. 9
   a. Level of bovine TB ..................................................................................................... 9
   b. Risk pathways for bTB infection ............................................................................... 11
   c. Role of other species ............................................................................................... 14
   d. Detection of cases ................................................................................................... 14
   e. Burden of bovine TB ............................................................................................... 16
   f. Key drivers of the bovine TB epidemic .................................................................... 17
6. Summary of the risk to the Edge Area from the HRA ......................................................... 18
7. Assessment of effectiveness of controls and forward look ................................................. 18

APPENDICES ..................................................................................................................... 19
   Appendix 1: Overview of risk and surveillance areas of England and Edge Area objectives and controls .................................................. 19
   Appendix 2: Cattle industry in Northamptonshire ............................................................ 20
   Appendix 3: Summary of Northamptonshire headline cattle TB statistics .......................... 21
   Appendix 4: Suspected sources of M. bovis infection for all the new OTF-W breakdowns identified in the report period ............................................................. 233
   Appendix 5: Overview of the bTB Control Programme in this Region of the Edge Area ........ 254
1. Executive Summary

a. The Edge Area was established in 2013 and was later incorporated into the Government’s strategy to achieve Officially Bovine Tuberculosis Free (OTF) status for England by 2038. It has a low but recently rising incidence of infected herds. This year-end report describes the bovine tuberculosis (bTB) epidemic in Northamptonshire, one of the counties forming the Edge Area.

b. Cattle industry – beef herds predominate (85.3%) with the majority being small suckler herds, followed by fewer (but larger in size) fattening units. Herds of up to 50 cattle represent nearly half (48%) of all herds. There is one livestock auction market (Thrapston Market) in Northamptonshire, but substantial trade of cattle is via Rugby Market in Warwickshire and Thame Market in Oxfordshire, which may have contributed to the infection creep from these two counties.

c. Overview of bTB epidemic - In comparison with 2016, the number of incidents (new breakdowns) in 2017 has increased by seven, from 18 to 25. Two of the Officially Bovine Tuberculosis Free Status Withdrawn (OTFW) breakdowns were disclosed in Approved Finishing Units (AFUs) and subsequently excluded from further calculations for the purpose of this report. Incidents in such units are not associated with subsequent testing and due to the strict biosecurity measures highly unlikely to have an impact on the bTB epidemiology in the area. Detailed information on these two breakdowns is provided in Appendix 2. The number of lesion and culture-negative, but highly suspected, Officially Bovine Tuberculosis Free Status Suspended (OTFS) breakdowns in 2017 has risen by one (from 11 to 12), but the number of fully confirmed (OTFW) breakdowns has increased by 57% for the reporting period (from 7 to 11, AFU incidents excluded). While in 2016 all OTFW breakdowns were disclosed within the first six months of 2016, more than half of OTFW breakdowns (54%) were disclosed in the last quarter of 2017.

The occurrence of breakdowns in 2017 follows the same general pattern as the equivalent periods in 2015 and 2016. The majority of breakdowns are again distributed in the areas with generally higher cattle and holding density. Areas of endemic infection continue to be suspected. The cluster of OTFW breakdowns which formed during 2016 in Daventry parish (southwest of the county), and where the source of the majority of those breakdowns was attributed to wildlife, remains and is expanding. While these breakdowns were believed to be due to infection ‘creep’ from the Warwickshire and north Oxfordshire Edge Areas via wildlife, rather than cattle movement in 2016, it appears that holdings affected previously in Northamptonshire have managed to sustain the spread of bTB through infected wildlife in the locality.

d. Descriptive Epidemiology of bTB:

- **Level of bTB:** The herd incidence of bTB has been steadily increasing from 3.1% in 2015 to 3.5% in 2016 and then to 4.63% in 2017.

- **Risk pathways:** The predominant infection source for the 23 new breakdowns in the reporting period was considered to be infected wildlife (n=14). Badgers were most commonly implicated as a source in those cases, while wild? deer were suspected in addition to badgers in two breakdowns only. Inward cattle movement was deemed responsible for 26% of the breakdowns with the majority of them being OTFW. In 13% of breakdowns the risk pathway remained undetermined. Beef suckler herds had the highest number of breakdowns (n=17) and more than half of those were attributed to a wildlife source. Less than a fifth of all breakdowns were in fattening herds, but again wildlife as the source of infection was predominant. Only one dairy herd experienced an OTFS breakdown and this again was considered to be due to a wildlife source. Wildlife sources of infection have been clearly implicated in all herd sizes. Purchased infection (cattle movement) was significantly more common in 2017 among very small (<50 cattle) herds but still a risk for any herd size.

- **Role of other species:** There have been no laboratory confirmed isolations of *M. bovis* in other species. Submission rates are extremely low in other domestic species. However, a
Defra-funded study into the prevalence of bTB in found-dead badgers in the northern Edge Area was conducted by the School of Veterinary Medicine and Science - University of Nottingham in 2016-2017. Results from this survey are not available at the time of writing.

- **Detection of cases** - The majority (74%) of the cases were disclosed at routine annual surveillance herd testing (WHT). Only two breakdowns, both of them OTFW, were disclosed at tests used for enhanced surveillance: one was disclosed at a check test six months after restoration of OTF status in a breakdown herd (6M) and the other at pre-movement test (PRMT). In 2017 there were 14 suspected slaughterhouse (SLH) cases reported by the Food Standards Agency (FSA) compared to three in 2016. Six of the suspected cases were confirmed by culture, but only four were counted as new incidents since the other two were found in AFUs. The proportion of new OTFW incidents in 2017 disclosed by passive surveillance was similar to that for 2016 (around one third). A quarter of the OTFS breakdowns were disclosed at an inconclusive reactor (IR) retest in 2017 - this figure was significantly higher (45%) in 2016. Only one of the OTFW breakdowns was initiated by an IR retest.

- **Burden of bTB** - There was a substantial decrease in the number of reactors (n=105) detected in 2017 – a reduction of 76 from a total of 181 detected in 2016. The tuberculin skin test identified 62% of the reactors in 2017 – a similar proportion of reactors was disclosed by interferon-gamma testing in 2016. There was an average of four reactors per breakdown in 2017, a decrease of six (from ten) in 2015. There were 1.76 reactors per 1000 animal tests in 2017 compared to 2.94 in 2016.

- **Key drivers of the bTB epidemic** – infected badgers, inward cattle movement and recurrence of breakdowns are all considered to be responsible for the increased incidence of infection. Infected badgers continue to be the predominant source of infection in the areas with suspected endemicity development in the west of the county? and where recurrence of breakdowns has also begun to appear. In the meantime, movement of infected cattle are considered to be the main driver in the middle to eastern part of the county where new cattle herds are being built/expanded.

e. **Summary of risks from Low Risk Area and High Risk Area.** The summary of risks to Northamptonshire is unchanged from those detailed in the 2016 year-end report: the apparent emergence of endemic bTB in the Edge Areas of north Oxfordshire and Warwickshire and the risk of infection ‘creep’ via badgers (and possibly wild deer) from there into south west Northamptonshire. Cattle buying practices need to be improved with implementation of the principles of risk-based trading. Movements from the LRA have not been implicated in any incidents for the reporting period.

f. **Assessment of effectiveness of controls and forward look.** Enhancement of wildlife control measures is urgently needed in the face of the predominant risk to cattle in the county from infected wildlife. Greater emphasis should be placed on risk-based trading, e.g. by making herd/holding data more widely available at the point of sale to encourage industry ownership of disease control.

2. **Introduction**

A key action in the implementation of the Government’s objective to achieve Officially Bovine Tuberculosis Free (OTF) status for England by 2038 was to recognise the different levels of TB in different parts of the country and varying the approach to control accordingly. To this end three management regions or zones have been established. This report describes the epidemiology of bovine TB in Northamptonshire, which forms part of the Edge Area (see Appendix 1). This area has a low but recently rising incidence of infected herds and control efforts are seeking to slow down and reverse geographic spread, and reduce the
incidence rate, with the aim of obtaining OTF status for this area as soon as possible. A full description of the Region, its recent bTB epidemiology, industry structure etc. can be seen in the published Edge Area annual epidemiology reports for 2016.

3. Cattle industry in the Edge Area of the Northern region: Northamptonshire

In Northamptonshire beef herds predominate (85.3%), as shown in Figure 1, with the majority being small suckler herds followed by fewer (but larger in size) fattening units. Herds of up to 50 cattle represent nearly half (48%) of all herds as shown in Appendix 2 and Figure 2 below. Albeit still predominant, these very small cattle herds have reduced in number in comparison with last year, whereas the number of cattle herds with 51-100 animals and those having between 100 and 200 animals have increased in numbers suggesting that there is some tendency for herd enlargement. There is one livestock auction market (Thrapston Market) located in the eastern part of the county where the herd and cattle density is generally much smaller. Substantial trade of cattle is via Rugby Market in Warwickshire and Thame Market in Oxfordshire, which may have contributed to the infection creep from these two counties which also share the predominant genotype in Northamptonshire (10:a).

![Figure 1: Proportion of cattle premises by breed purpose](image)

![Figure 2: Proportion of cattle premises by herd size band](image)
4. Overview of the TB epidemic in Northamptonshire

a. History of TB in the county

Figure 3 shows a relatively even distribution of disclosure of new herd breakdowns with OTF status suspended (OTFS) throughout 2017 except in January when a third of those cases were disclosed. The OTFS breakdowns in 2016 followed a very similar pattern. There are some notable differences with new herd incidents with OTF status withdrawn (OTFW). There was a spike of OTFW breakdown disclosures in April 2016 (four cases) which was preceded by a month with no breakdowns. **All (n=7) OTFW breakdowns in 2016 were disclosed in the first half of the year.** Although 2017 saw a smaller number (n=4) of OTFW breakdowns over the first six months, the last quarter of the year saw high number (n=6, accounting for 54%) of confirmed breakdowns in contrast to none in 2016. Nearly a third of all new breakdowns in 2017 began in the last quarter of the year with OTFW breakdowns predominating significantly. The data for the number of OTF herds tested per month was not available and it is unclear if the number of breakdowns disclosed is directly proportional to the number of tests carried out throughout the year. However the increased incidence in the last quarter of 2017 is due to 67% of OTFW breakdowns in that specific period being disclosed by slaughterhouse surveillance (SLH; n=3) and a six month check test (6M, n=1) whilst all of the OTFS breakdowns (n=2) were disclosed by routine whole herd testing (WHT).

![Figure 3: Distribution of new breakdowns (OTFS and OTFW) per month for 2016 and 2017](image)

b. Geographical distribution of bovine TB cases (new and ongoing) in Northamptonshire

The geographical distribution of all new TB breakdowns (OTFS and OTFW) in 2017 and any OTFW breakdowns which started prior to 2017 and were still ongoing at the end of the reporting period is shown overlaid on a map showing the cattle holding density for the Midlands Edge Area. (Figure 4).
Figure 4: Geographical distribution of all new TB breakdowns (OTFS and OTFW) in 2017 and any pre-2017 OTFW breakdowns still ongoing at the end of the report period overlaid on a cattle holding density map, with a cattle density map for the area inset (NB only breakdowns which occurred within the Edge Area outlined in red are shown).
The occurrence of cases in 2017 follows the same general pattern as the equivalent periods in 2015 and 2016. The majority of breakdowns are again distributed in the areas with generally higher cattle and holding density. In 2016 there was a reduction in the number of cattle holdings in the tip of the southwest of Northamptonshire which has remained unchanged in 2017. A cluster of breakdowns had formed in 2015 in this specific area (Brackley). There is no change in the cattle density in that same area suggesting that the herds remaining there have increased in size.

A gradual north-west shift of the distribution of breakdowns can be seen over the last three years. The above mentioned cluster of breakdowns in the Brackley area cleared in 2016. The area remained incident free until late in 2017 with one breakdown in November, attributed to inward cattle movement. Nearly half of the OTFW breakdowns for 2016 were clustered again but further north (Daventry area) than those in 2015 and in proximity to a group of breakdowns in Southam, east Warwickshire (this cluster was formed in 2015). The Daventry cluster of breakdowns has remained and expanded in 2017 involving both recurring and first time incidents. Genotype 10:a was isolated in three of the cases in the Southam area in 2015. Subsequently five of the seven OTFW breakdowns in 2016 in Northamptonshire were caused by the same genotype, 10:a, and one was 10:7-5-6-4*-3-3.1 (closely related to 10:a). In 2017 there was an increase in the number of breakdowns caused by the latter mentioned genotype which somewhat seems to be replacing 10:a in the area where it was most commonly found in the preceding year.

Figure 5 demonstrates the number of incidents with the infection source attributed either to locally-acquired infection or to the movement of TB-infected cattle into Northamptonshire from higher risk counties of GB. The classification of a case as being due to the movement of cattle is based on factual evidence that those breakdowns had their origin of infection due to inward cattle movement with no subsequent lateral spread from the farm of destination in Northamptonshire.

The genotypes associated with the cattle movement incidents in 2017 were 17:a and 97:a, whilst in 2016 the only cattle movement incident was 35:a. In 2017 one visibly-lesioned animal failed to yield positive culture result and another case had the extremely rare genotype of 130:7-5-5-4*-3-3.1. This genotype has so far been found only three times in the whole of England and Wales (the other two cases being located in Oxfordshire). Considering the genotypes (Figure 6) the location of the breakdowns and the associated (in the majority of cases) wildlife involvement, the previous suspicion of infection ‘creep’ from east Warwickshire and north Oxfordshire due to wildlife infection rather than cattle movement is reinforced. The parish of Boddington (the only one in Northamptonshire bordering both Warwickshire and Oxfordshire) is experiencing, in two consecutive years, the highest incidence and prevalence, due to the large number of reactors found in herds with breakdowns recurring less than six months following the previous breakdown.
In 2017 there were a total of 23 new breakdowns compared to 18 over the same period in 2016. While in 2016 the number of OTFS breakdowns was more than a third higher than the number of OTFW, in 2017 the two types reached almost equal figures. This was due to the significant (57%) increase in the number of OTFW breakdowns, while the number of OTFS breakdowns saw a very slight elevation, by one case only. Therefore the 28% increase in the total number of breakdowns in 2017 was mainly due to an increase in the number of OTFW incidents disclosed. Figure 7 below shows the differences between the numbers of OTFS and OTFW breakdowns for 2015, 2016 and 2017.

5. Descriptive epidemiology of bovine TB in Northamptonshire

Level of bovine TB

Incidence

The incidence of bTB breakdowns in Northamptonshire was calculated for 2014-2017 and these are shown in Figure 8 below. The data from previous years have changed slightly to allow better comparison with the 2016 and 2017 data. This is due to the increase in testing as a result of more six monthly and contiguous testing in Northamptonshire, and so the incidence calculation has been
amended to ensure reporting of an annual incidence based on unique herds tested rather than number of tests.

Figure 8: Incidence over the period of 2014-2017 calculated for all new breakdowns (OTFS and OTFW) in the reporting period as a percentage of unique OTF cattle herds tested in the reporting period

Northamptonshire has shown a low, relatively stable incidence rate between 2014 and 2015, with a slight decline over the latter year. Since then a notable increase in the incidence can be seen over the last two years with a 30% rise in 2017. This means that there was a 4.63% chance for any herd in Northamptonshire to become infected with bTB during 2017. This figure is a clear reflection of the reduced number of cattle herds in the county in the face of increased number of breakdowns over the last year. In a significant number of the breakdowns which were new in the reporting period, infection is thought to have originated in the local area (especially in south-west parts of the county) signifying a potential for endemicity. More focus is needed on preventing the infection from becoming established in the local wildlife.

There seems to be a new found appreciation among the farming community of the importance of this risk pathway. A Northamptonshire local TB Eradication Group (TBEG) has been established recently with the support of the National Farmers Union (NFU). So far, however, discussions about the risk of introduction of disease from contact with wildlife, badgers in particular, tends to be addressed in a one-sided manner: how to reduce the number of badgers. APHA membership of the steering group will help not only to highlight the importance of industry taking ownership of the problem by improving biosecurity on farm, but also to promote the use of the available Defra-funded TB Advisory Service. Tighter disease control measures in cattle herds (such as introduction of radial testing from January 2018 and restrictions for life of resolved IRs from November 2017) are now in place to help prevent the infection creep from neighbouring counties. The preliminary effects of these measures will be assessed in the report for 2018.

The average length of a TB breakdown increased in 2017 to 200 days, compared to 158 days in 2016. Possible explanation for this is the new policy measure introduced in 2017 where once in a breakdown situation any further testing for the herd is completed at least 60 days post reactor removal rather than 60 days post reactor isolation. This measure increases on average the length of the breakdown with two weeks per test with reactors. There were three prolonged (but not classed as persistent) breakdowns in 2017 having their start date in either 2015 or 2016. One of them lasted just under 18 months and the other two 13 and 14 months respectively. A very similar pattern was observed in 2016.
b. Risk pathways for bTB infection:

Figure 9: All new breakdowns in 2017 with origin of infection and genotype where known (Creator: Stafford GIS team)
As shown in Figure 9, the infection source for the 23 new breakdowns in the reporting period in Northamptonshire was mainly wildlife (n=14). This has more than doubled since 2016 when six breakdowns were attributed to wildlife. Only two in 2017 were believed to have been caused by contact with wild deer but for the other twelve breakdowns, badgers were considered to have been the main source of infection. Purchased cattle from holdings or areas with a higher disease risk were considered to be the risk pathway for disease introduction in six of the 23 breakdowns. Three breakdowns had an obscure origin, with only one being OTFW. In one of these cases two different sources of infection (purchased and wildlife) were considered to have been equally likely.

Figure 10 below demonstrates the significant increase in the number of breakdowns considered to have been caused by contact with wildlife, from six in 2016 to fourteen in 2017. This reinforces the theory from previous years that there may be establishment of infection in a wildlife reservoir in specific western parts of the county, increasing the likelihood of endemicity.

Figure 10: Origin of infection for all new breakdowns in 2016 and 2017

Figure 11 demonstrates the source of infection by herd type. Beef suckler herds had the highest number of breakdowns (n=17) and more than half of these were attributed to a wildlife source. Less than a fifth of all breakdowns were in fattening herds but again wildlife as source of infection was predominant. Only one dairy herd experienced an OTFS breakdown and this again was considered to be with wildlife source. This clearly implicates wildlife as a hazard for all cattle herds regardless of purpose. From data described previously in Figure 2, the majority of cattle herds in Northamptonshire are beef with very few dairy units. This explains the higher incidence of disease in the beef sector. Additionally, the majority of beef herds in the county are suckler rather than fattening units. Many suckler farms tend to also have small groups of fattening stock, usually comprising homebred younger stock. Such herds have been reported as suckler herds for the purpose of this report - this may have had a slight influence on the statistics with regards to cattle sectors. The fattening herds tend to have a much quicker turnover of cattle, making any potential infection harder to establish within the herd or to spill over into the wildlife or other cattle premises.
As shown in Figure 12, no specific trend can be noted regarding the size of the cattle herds and the occurrence of OTFW and OTFS breakdowns except that OTFW cases have not been identified in very large (500+) herds. Wildlife source of infection, as can be seen in Figure 13, has clearly been implicated in all sizes of herd. Purchased infection (cattle movement) was significantly more common in 2017 among very small (<50) herds but still a risk for any herd size.

Wildlife source of infection, as can be seen in Figure 13, has clearly been implicated in all sizes of herd. Purchased infection (cattle movement) was significantly more common in 2017 among very small (<50) herds but still a risk for any herd size.
c. Role of other species:

- Badgers and other wildlife
  The University of Nottingham carried out a Defra-funded survey of found-dead badgers in the northern Edge Area in 2016-17. Results are unavailable at the time of writing.
  There have been no laboratory confirmed isolations of *M. bovis* in other wild animals such as wild deer or wild boar carcases in 2017.

- Other domestic species:
  There have been no laboratory confirmed isolations of *M. bovis* in domestic non-bovine farm animals (camelids, goats, sheep, and pigs), pets, zoo animal collections, captive (farmed/park) deer holdings and captive wild boar farms in 2017.

d. Detection of cases:

Figure 14 displays the proportion of OTFW and OTFS breakdowns disclosed in 2017 by different surveillance methods. It can be seen that all of the OTFS and almost half of the OTFW breakdowns were disclosed by routine annual surveillance whole herd testing (WHT). It can also be seen that more than half of the OTFW breakdowns were first detected by either passive or enhanced surveillance testing, demonstrating the efficacy of the additional measures in place.
Figure 15 shows the number of breakdowns disclosed by different surveillance test types. The majority of the cases were disclosed at WHT. Only two breakdowns were disclosed at tests used for enhanced surveillance: one was disclosed at a six month post breakdown test (6M) and the other at a pre-movement test (PRMT). In 2017 there were 14 suspected SLH cases reported by the Food Standards Agency (FSA) compared to three in 2016. Six of them were confirmed by culture but only four counted as new incidents since the other two were found in AFUs. In one of the cases the animal had been showing responsiveness to both avian and bovine tuberculin since 2014. It had been identified as an IR in 2016 and development of anergy could be suspected. Another case was an animal born towards the end of a breakdown in a Worcestershire holding and subsequently undetected as infected by the PRMT: genotyping confirmed the natal holding as the origin of infection. This could have been a result of either delayed immune response in the individual animal, inadequate testing (since two more animals from this origin herd bought along with the index case also showed visible lesions at slaughter) or simply highlights the limitations of skin test sensitivity when applied to individual animals. The other two cases involved younger animals from areas in the county where endemicity in wildlife is strongly suspected and testing history strongly indicated exposure to the hazard during the summer months of 2017 after their herd test.

![Figure 15: Number breakdowns disclosed by different test types](image)

Figure 15: Number breakdowns disclosed by different test types

Figure 16 demonstrates the number of breakdowns disclosed at IR retest in comparison to the numbers of cases triggered by reactors at the initial skin test.

![Figure 16: Number of new breakdowns on 2016 and 2017 detected as reactors at initial skin test and at an IR retest](image)

Figure 16: Number of new breakdowns on 2016 and 2017 detected as reactors at initial skin test and at an IR retest
All but one case disclosing IRs occurred in the first half of the year which is very similar to that observed in 2016. A quarter of the OTFS breakdowns were disclosed at an IR retest while this figure was significantly higher (45%) in 2016. Only one of the OTFW breakdowns was initiated by an IR retest and this was the only IR that was a purchased animal with the genotype matching the herd of origin. This animal, and two of the other three IRs starting new incidents, were young animals showing double positive response for the first time at the test disclosing them as IRs. The last IR was an old animal which had shown double positive (but negative testing) reactions for the last six years. Apart from the purchased IR, all cases were in areas where badgers were identified as the most likely cause of disease introduction to the herd. These IRs suggest either latent infection (in the case of the older animal with longstanding reactivity) or early infection where immune response to the *M. bovis* was not strong enough to identify the animal as a reactor (possibly individual animal, environmental and management factors have had some effect too).

e. Burden of bovine TB

The number of reactors removed in Northamptonshire in 2016 and 2017 (for both new and ongoing breakdowns) is shown in Figure 17. The total number of reactors removed has decreased by 41% in comparison with the same period over the last year. This is an apparent improvement since last year when a 68% increase in the total number of reactors being removed was seen in comparison with 2015. Of the total number of reactors removed in Northamptonshire in 2017, 62% were identified as such by skin testing. This figure is a reverse image of the situation in 2016 when the same proportion of reactors were identified by the interferon-gamma test.

![Figure 17: Number of reactors removed showing the numbers detected by skin test and interferon-gamma test in new and ongoing breakdowns in 2015, 2016 and 2017](image)

The reduction in the number of reactors needs to be interpreted with caution. There were three new breakdowns in 2017 which did not have the associated breakdown testing as the remaining stock was depopulated prior to the start of breakdown testing. All three were small herds, one OTFS and two OTFW, and therefore unlikely to have had a significant impact on the total number of reactors in the county should the cattle have remained in the herd and have been tested. More notable is the time of occurrence of OTFW breakdowns during 2017. As previously mentioned the majority of breakdowns occurred in the last quarter of the year which means that all breakdown skin and interferon-gamma testing will take place in early 2018. This is similar to what was seen in 2015 which led to the significant increase specifically in the numbers of interferon-gamma reactors in 2016: 73% were from breakdowns having their start date in 2015. In 2016 there were two particular breakdowns which contributed to nearly a third of all the reactors removed for that year. Again in 2017 two (other) herds have contributed to
nearly half of all the reactors removed in the county for this reporting period. Therefore the significant difference in reactor numbers cannot be attributed to individual, more problematic herds. The main trigger is the time of new incidence occurrence. It should also be noted that 11 of the 39 interferon-gamma reactors removed in 2017 were from a test carried out in addition to the statutory requirements for such testing: this was in an OTFS herd where interferon-gamma testing was conducted at the case vet’s discretion. Ongoing breakdowns during the reporting period contributed to 7.5% of the total skin test reactors while this was twice as high (16%) for 2016. To a great extent the epidemiological events in 2017 mirror those from 2015 but with a reduction in the burden of disease despite the increased incidence. This may be because the new breakdowns in 2017 were being detected earlier in the course of disease, controlled better and eventually leading to fewer reactors in total. This is a positive trend, reducing the burden on farmers and taxpayers alike. It remains to be seen if the late onset of a significant number of breakdowns in 2017 will lead again to significantly increased disease burden in 2018.

The decrease mentioned above is also reflected in the number of reactors per breakdown and per 1000 animal tests. Figure 18 shows that on average there were four reactors per breakdown in 2017 which is a 60% decrease in comparison to the same period in 2016. In 2016 there was a 60% increase in that figure in comparison to 2015. There is a proportionate and correlating reduction between number of cattle herds, number of cattle, number of herd tests carried out and number of cattle tested. These may therefore be seen as a reason for the general reactor number reduction but cannot really influence the figures in the chart presented below. The number of reactors per 1000 animal tests in 2017 has decreased to 1.76 in 2017 from 2.94 in 2016 which is consistent with all previous statements.

![Figure 18: Number of reactors detected per breakdown and per 1000 animal tests in new and ongoing breakdowns in 2015, 2016 and 2017](image)

f. Key drivers of the bovine TB epidemic

- Infected badgers

It is of note that there is increasing year on year anecdotal evidence that badgers are a source of infection in a significant number of breakdowns. In 2017 this source was particularly notable in beef suckler herds (58%). As reported in previous years, this pattern of cases with badgers as the source of infection could be indicative of the emergence of endemic disease in the south west of
Northamptonshire. The final results from the Defra-funded Edge Area Badger Survey are not available at the time of writing, but may help to provide more information regarding badger infection in the area.

- **Cattle movement**

The inward movement of cattle to or between holdings in the county also remains a concern as these have been responsible for the introduction of infection into small to medium sized suckler herds. This suggests that unsafe trading practices when breeding stock is purchased or new herds are built still poses significant risk, especially in areas with low or no incidence prior to this reporting period. The continued lack of a concentrated industry effort to implement risk-based trading strategies is a driver for a proportion of the epidemic or risk of spread. APHA intend to raise awareness of this risk as part of the steering group in the newly founded local TB eradication group in the county.

- **Recurrence and persistence**

Two of the herds with OTFW breakdowns in 2017 have experienced a very recent recurrence from previous breakdowns: one herd had a slaughterhouse case disclosed prior to its 6M post-breakdown test and the second herd had a skin test reactor at its 6M post-breakdown test. Both herds are located in Boddington parish, in the south of the county. In both cases new exposure to wildlife during the grazing season or residual infection were considered to be equally possible, considering previous reactivity, age, grouping in the herd, and the length of time spent on farm.

### 6. Summary of the risk to the Edge Area from the High Risk Area

The summary of risks to Northamptonshire is unchanged from those detailed in the 2016 year-end report: the apparent emergence of endemic infection in the Edge Area of in north Oxfordshire and Warwickshire and the risk of infection ‘creep’ via badgers (and possibly wild deer) into south west Northamptonshire. Cattle buying practices need to be improved too – implementation of the principles of risk-based trading would support this.

### 7. Assessment of effectiveness of controls and forward look

Incidence rates have increased, which is mainly due to lateral spread of disease. This is considered to be mainly through wildlife rather than cattle movement in the western parts of the county where herd and cattle density is highest. The apparent reduced burden of disease (number of reactors per breakdown) is encouraging and potentially suggesting that TB policy implemented control measures are enabling timely disclosure of infected animals. Due to reasons mentioned previously, the reduced burden of disease needs to be reviewed along with results from the upcoming year.
APPENDICES

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

Figure A1: Bovine TB risk and surveillance areas of England effective since January 2013, as set out in the Government’s Strategy for Achieving Officially Tuberculosis-Free Status for England.

1.1 Policy objectives for the Edge Area:
Short to medium term:
- a. slow down geographic spread
- b. maintain crude herd incidence of OTFW breakdowns <2% overall by 2019
- c. begin to reduce the incidence rate

Longer term:
- d. reduce geographic spread of bTB and push the Edge Area boundaries westward
- e. reduce OTFW herd incidence to <1% by 2025
- f. attain OTF status (incidence of indigenous OTFW herd breakdowns <0.1) for the lowest incidence counties in the Edge Area.

1.2 Key Control Measures
Surveillance
- a. enhanced herd test coverage (annual)
- b. extend targeted surveillance to 3km around new OTFW breakdowns in Cheshire and Derbyshire (radial testing), with six month follow-up
- c. possible RTA badger survey

Management of cases (‘breakdowns’)
- a. increased sensitivity of breakdown herd testing:
  - OTFS breakdowns to pass two short interval tests at severe interpretation to regain OTF status
  - mandatory IFN-g parallel testing in OTFW
- b. enhanced epidemiological investigation and data analysis
- c. information sharing - location of breakdown herds
Appendix 2: Cattle industry in Northamptonshire

Number of cattle premises by size band in Northamptonshire

<table>
<thead>
<tr>
<th>Cattle per premises</th>
<th>1-50</th>
<th>51-100</th>
<th>101-200</th>
<th>201-350</th>
<th>351-500</th>
<th>501+</th>
<th>All</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of premises 2016</td>
<td>272</td>
<td>104</td>
<td>79</td>
<td>53</td>
<td>23</td>
<td>12</td>
<td>548</td>
<td>101</td>
<td>49</td>
</tr>
<tr>
<td>Number of premises 2017</td>
<td>258</td>
<td>117</td>
<td>86</td>
<td>44</td>
<td>20</td>
<td>13</td>
<td>543</td>
<td>100</td>
<td>52</td>
</tr>
</tbody>
</table>

- **Number of Approved Finishing Units registered in Northamptonshire:**
  There are 12 Approved Finishing Units (AFU) in Northamptonshire. There is no change in numbers from last year, although one new unit was approved in 2017 but another one ceased operating. As for all AFUs in the Edge Area, these units are non-grazing and if correctly operated are not considered a risk for introduction or spread of bTB into the surrounding areas. Two new incidents found at slaughterhouses originated from such units.

In one of the cases the animal originated from an OTF herd, but from the High TB Area of West Wales. The genotype associated with this incident was 9:b, whose home range spans both the location of the farm of origin of the index animal in West Wales and that of the herd of origin. The animal lived most of its life on a holding which had experienced a number of breakdowns although none of which occurred while residing there. The animal had been three times to Welsh markets and was sold to the AFU in Northamptonshire through a Welsh dealer. This is a clear example of the risk of bringing infection into lower risk areas from herds in higher risk areas of England or Wales, regardless of the fact that they may be considered to be OTF at the time of sale.

The other case was caused by an animal which originated from a herd under restrictions due to a TB breakdown, with the animal having been moved as a negative-testing animal just after the beginning of the breakdown. After a year at the Northamptonshire AFU, visible lesions consistent with bTB were detected at slaughter and the genotype matched the one for the herd of origin. This animal was most likely in an early stage of infection when it left the breakdown herd, undetectable as yet by the skin test.

No other breakdowns with matching genotypes have been found to date within 20 km of these units. This suggests that no lateral spread has occurred at the time of reporting, which is to be expected because of the strict biosecurity measures implemented in non-grazing AFUs.

- **Common land in the County:** Some small areas of common land in Northamptonshire are present, with low numbers of cattle grazed and no significant co-grazing by more than one herd. Spread of bTB related to common land is unlikely in this county.

Cattle/herd purpose:

In Northamptonshire beef herds predominate (85.3%) with the majority being small suckler herds followed by lower in number but larger in size fattening units. Herds of up to 50 cattle represent nearly half (48%) of all herds as shown in the table below and Figure 1 above. Albeit still predominant, these very small cattle herds have reduced in number in comparison with last year, whereas the number of cattle herds with 51-100 animals and those having between 100 and 200 animals have increased in numbers suggesting that there is some tendency for herd enlargement.

<table>
<thead>
<tr>
<th></th>
<th>Beef</th>
<th>Dairy</th>
<th>Dual purpose</th>
<th>Unknown</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>%</td>
<td>Number</td>
<td>%</td>
<td>Number</td>
</tr>
<tr>
<td>Cattle 2017</td>
<td>46,357</td>
<td>85.3</td>
<td>6,225</td>
<td>11.5</td>
<td>1,745</td>
</tr>
<tr>
<td>Cattle 2016</td>
<td>46,324</td>
<td>83.6</td>
<td>7,413</td>
<td>13.4</td>
<td>1,670</td>
</tr>
</tbody>
</table>
Appendix 3: Summary of the Northamptonshire headline cattle TB statistics

### Herd-level statistics

<table>
<thead>
<tr>
<th>Description</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Total number of cattle herds live on Sam at the end of the reporting period</td>
<td>634</td>
<td>625</td>
<td>608</td>
</tr>
<tr>
<td>b. Total number of herd tests carried out in the period</td>
<td>812</td>
<td>738</td>
<td>717</td>
</tr>
<tr>
<td>c. Total number of OTF cattle herds TB tested during the period for any reason</td>
<td>766</td>
<td>511</td>
<td>496</td>
</tr>
<tr>
<td>d. Total number of OTF cattle herds at the end of the report period (i.e. herds not under any type of TB02 restrictions)</td>
<td>601</td>
<td>599</td>
<td>570</td>
</tr>
<tr>
<td>e. Total number of cattle herds that were not under restrictions due to an ongoing TB breakdown at the end of the report period.</td>
<td>617</td>
<td>607</td>
<td>579</td>
</tr>
<tr>
<td>f. Total number of new TB breakdowns detected in cattle herds during the report period(^1)</td>
<td>16</td>
<td>18</td>
<td>25</td>
</tr>
<tr>
<td>• OTF status suspended (OTFS)</td>
<td>8</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>• OTF status withdrawn (OTFW)</td>
<td>8</td>
<td>7</td>
<td>13 (2 in AFUs)</td>
</tr>
<tr>
<td>g. Of the OTF-W herd breakdowns:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• How many can be considered the result of movement, purchase or contact from/wth an existing breakdown based on current evidence?</td>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>• New OTFW breakdowns triggered by skin test reactors or 2xIRs at routine herd tests</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>• New OTFW breakdowns triggered by skin test reactors or 2xIRs at other TB test types (forward and back-tracings, contiguous, check tests, etc.)</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>• New OTFW breakdowns first detected through routine slaughterhouse TB surveillance</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>h. Number of new breakdowns revealed by enhanced TB surveillance (radial testing) conducted around those OTFW herds (may not be applicable to every county in the Edge Area)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• OTFS</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>• OTFW</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>i. Number of OTFW herds still open at the end of the period (including any ongoing OTFW breakdowns that began in a previous quarter)</td>
<td>5</td>
<td>3</td>
<td>9 (2 in AFUs )</td>
</tr>
<tr>
<td>j. New confirmed (positive <em>M. bovis</em> culture) incidents in non-bovine species detected during the report period (indicate host species involved)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Animal-level statistics (cattle)

<table>
<thead>
<tr>
<th>Description</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Total number of cattle tested in the period (animal tests)</td>
<td>56,012</td>
<td>61,589</td>
<td>59,587</td>
</tr>
<tr>
<td>b. Reactors detected:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• tuberculin skin test</td>
<td>41</td>
<td>67</td>
<td>66</td>
</tr>
<tr>
<td>• additional IFN-gamma blood test reactors (skin-test negative or IR animals)</td>
<td>67</td>
<td>114</td>
<td>39</td>
</tr>
<tr>
<td>c. Reactors per breakdown</td>
<td>6.35</td>
<td>10</td>
<td>4</td>
</tr>
</tbody>
</table>

\(^1\) In some cases there is minor variation (under 4) between the total number of breakdowns reported in the Year End Descriptive Epidemiology Reports for individual counties and the report on Bovine tuberculosis in England in 2017. These are due to differences in the breakdown case definition, where incidents first detected in late 2016 are included as 2017 breakdowns in the individual county reports; and where incidents occur in epidemiologically linked premises.
<table>
<thead>
<tr>
<th></th>
<th>Reactors per 1000 animal tests</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>d.</td>
<td></td>
<td>1.93</td>
<td>2.94</td>
</tr>
<tr>
<td>e.</td>
<td>Additional animals identified for slaughter for TB control reasons (DCs, including any first-time IRs)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>f.</td>
<td>SLH cases (tuberculous carcases) reported by FSA</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>g.</td>
<td>SLH cases confirmed by culture of <em>M. bovis</em></td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
## Appendix 4: Suspected sources of M. bovis infection for all the new OTFW breakdowns identified in the report period

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction (e.g. purchase) of infected animal(s)</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>5 (2 in AFUs)</td>
</tr>
<tr>
<td>Local - lateral spread from neighbouring holdings</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>• exposure to infected wildlife</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>• other farmed species</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>• recrudescence of residual infection from a previous TB breakdown</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>• infected human source</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Undetermined/obscure</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Other (explain)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

All new OTFW breakdowns identified in Northamptonshire were categorised using the following risk matrix, according to (a) the probability of them being the result of introduced infection (inward cattle movements) and (b) the strength of evidence that we are dealing with an isolated incident without further propagation from the index farm to neighbouring herds (or vice versa). The corresponding numbers of breakdowns have been entered in the relevant boxes. The uncertainties that result in cases being included in the ‘possible’ column or row are described in the narrative text below.

<table>
<thead>
<tr>
<th>Probability of isolated, sporadic (‘one-off’) breakdown, without secondary cattle to cattle spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability of introduced <em>M. bovis</em> infection</td>
</tr>
<tr>
<td>Definite</td>
</tr>
<tr>
<td>Likely</td>
</tr>
<tr>
<td>Possible</td>
</tr>
<tr>
<td>Not likely (indigenous infection in the locality)</td>
</tr>
</tbody>
</table>

List the CPHs of those herds with OTFW breakdowns categorised as definite or likely introduced cases with no evidence of local spread (greyed-in boxes):

- Index case purchased four months before being disclosed as a reactor, ex holding which has no bTB history. All previous holdings of residence had no TB history either. Genotype 97:a (very rare) was identified. It has been found only five times previously - four cases in Staffordshire and one in Derbyshire - two cases in 2008, one in 2009, two in 2012 in a cluster of parishes on the Staffordshire/Derbyshire border. The herd of origin is in a parish with relatively low incidence but a holding from this parish was contiguous to the only Derbyshire holding which had 97:a. However this
contiguous herd has had no history of TB breakdowns either. Badger activity in the whole area is evident from reports. The index animal was purchased along with two more cows with their calves. The cows were slaughtered after the index case was disclosed as a reactor but the calves were retained. One of these calves tested positive to the interferon-gamma test.

- reactor born at Wiltshire (HRA) - the herd was OTFW (17:a) at the time this specific animal was born. It moved at the age of 13 months to (Buckinghamshire). After only two weeks it was moved to the incident farm via a market. It resided there for six months before being disclosed initially as an IR at a WHT and then becoming a reactor at re-test. The genotype of the isolate matched the one for the farm of origin. The assessment was also reinforced by the fact that another animal from the farm of origin, born at the same time as this index case, also became a reactor with the same genotype (17:a) at a different holding. It is clear there was residual infection in the herd of origin which spread with the sold animals.

- Index case was born in the middle of a breakdown in Wiltshire, bought in a batch of 16 cattle. A few months later two other animals from the same batch disclosed visible lesions at slaughter. The herd of origin suffered a breakdown again a few months after the sale, with matching genotypes. The only holding in 20km radius with the same genotype and this is an AFU, and unlikely to have an epidemiological link with this holding. Due to the location of the holding in an area with increased incidence and the late occurrence in the year of this breakdown (in November 2017) the current assessment for no further propagation is provisional and will be reviewed upon receipt of further data.

- both holdings are AFUs. For more information please refer to Annex 2

Appendix 5: Overview of the bTB Control Programme in this Region of the Edge Area

5.1 Edge Testing Policy
- Discretionary interferon-gamma testing was applied to one OTFS herd. The case vet had considered that some of the breeding stock in the herd represented a high risk of infection and instructed the additional testing which disclosed 11 reactors, all of which showed no visible lesions (NVL).

5.2 Unusual bTB breakdowns
- Sole reactor had visible lesions but the culture was negative. Purchased animal, but nothing to suggest that infection was from the origin holding or from any other purchased stock. Not enough evidence either to suggest environmental contamination which could explain the type of lesions found (not many breakdowns in the area to suggest infected wildlife, one badger set out of the farm land, but possibly latrines on grazing fields). No other reactors found but breakdown testing was not completed due to natural depopulation of the herd. Non-specific reaction to PPD is possible but needs to be noted that lesions in the alimentary tract are usually heavily contaminated with concurrent bacteria which may be able to survive the acid treatment during processing and subsequently hinder the growth of M. bovis.
- Three breakdowns in total (two OTFW and one OTFS) did not go through breakdown testing due to natural depopulation of the herds prior to first short interval test All three herds were small beef herds.

5.3 Other Testing Measures
- A herd with a longstanding overdue WHT was compulsorily slaughtered in May 2017, thereby eliminating the disease risk posed by that herd.

5.4 Other Control Measures
- A Northamptonshire local TB Eradication Group (TBEG) was set up in 2017 with the support of local NFU. One of the local APHA field vets has been invited to be part of the steering group. So far one meeting has been held. This will be used as an opportunity for industry, private veterinary surgeons and APHA representatives to meet, discuss and work together toward reducing TB in the county.
- Restriction of resolved IRs for life to the farm where first identified as IR.
- Once in a breakdown situation any further testing is completed at least 60 days post reactor removal rather than 60 days post reactor isolation. This measure ensures that in cases where isolation of reactors is not properly maintained any animals that may have been exposed to the hazard from the reactor while awaiting removal, will still be allowed sufficient time to mount a detectable immune response to the skin test.
Measures which will be implemented from 1st January 2018 are:

- radial testing in yearly testing Edge counties
- Decoupling of the interferon-gamma test from the skin test, the aim being to apply the interferon-gamma test as soon as a breakdown has been confirmed (by visible lesion or positive culture result) to allow for any exposed/infected animals missed by the skin test to be removed as soon as possible and hopefully shorten the duration of the breakdown.

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.