TB Awareness in Camelids

Presented by
Dr Gina Bromage, MA, Vet MB, DVM, MRCVS

at meetings organised by the British Alpaca Society
and supported by British Camelids Limited, the British Llama Society,
the British Veterinary Camelid Society, Defra Animal Health and
The Veterinary Laboratories Agency
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Suspected transmission of *Mycobacterium bovis* between alpacas
DF Twomey, TR Crawshaw, AP Foster, RJ Higgins, NH Smith, L Wilson, K McDean, JL Adams, R de la Rua-Domenech (all from the Veterinary Laboratories Agency or Animal Health)
Letter to the *Veterinary Record*, 25 July 2009

Self-declaration Form
A very Brief History of TB

In the pre-WW II, pre-penicillin days, a poster for Red Cross Christmas Seals captures the hopelessness that once was felt in the face of tuberculosis.

This was the situation amongst the populations of many of the world’s major cities where malnutrition and overcrowding created the ideal environment for TB to take hold. In this context the host was human. Farm and wild animals all were equally susceptible hosts. It was always thus: way back in the depths of time, the footprint of TB has been observed. Some reports indicate that we caught TB from the animal kingdom, others conclude that we gave it to them.

Preserved mummies from Egypt and Peru, to the expert eye, showed the signs of TB. This picture shows the mummy of a newborn male child, it exhibits lesions of the lung indicating a tuberculosis infection. The supporting document is available at:
http://jcm.asm.org/cgi/content/full/41/1/359/

It may well be worth pondering on this illustration, in particular the two significant words – newborn and TB – in the context, the resulting in-depth analysis indicate it to be M. Bovis.

In my meanderings which follow it needs to be recognised that there is essentially no difference between human Tuberculosis and animal Bovine Tuberculosis. Only the most detailed laboratory analysis will differentiate between them; the difference is academic. Both have essentially similar clinical signs and the pathogenesis is very similar.

In the early days it was recognised, maybe not understood, that the best natural defence against all forms of TB was the establishment and maintenance of a really first rate immune system, which is only at its best amongst those – animal or human – who are in good health, well nourished and stress free. This offered the best chance of fighting TB and, of course, many other ailments, although infectious load plays an important part also.
In the 1940s vitamin supplements, particularly Vitamin ‘D’ in the form of ‘Cod Liver Oil’, were part of the family breakfast, prevention being better than cure.

There is more good reading at:
http://ajrccm.atsjournals.org/cgi/reprint/176/2/208?maxtoshow=&HITS=10&hits=10&RESULT FORMAT=&author1=Adrian%2BMartineau&searchid=1&FIRSTINDEX=0&resourcetype=HWCIT

Unfortunately the less fortunate and undernourished humans (and animals) in poor overcrowded environments fared less well. Shut in a factory or cow shed, the effects were the same.

‘Coughs and Sneezes spread diseases’ was a well documented campaign in the 1940s.

The little droplets (aerosols) of TB-contaminated moisture sneezed, coughed or spat out could easily be inhaled by others of the close family group. Regrettably our five senses, sight, sound, smell, touch and taste, will fail to warn you of its presence.

But, all is not lost. Our immune system’s Antigen Presenting Cells (APC’s) (Armoured Personnel Carriers) macrophages, backed up by ‘T’ cells are on duty 24/7/365. They WILL detect the TB mycobacterium invaders within hours and mount a response (counter attack).


At this point that there is in fact an ‘Elephant in the Room’, maybe at present only a baby elephant, but it would be good for us to know about its existence. There are tests. In fact, there are a number of tests: an Intradermal Skin Test, Mantou Test, Gamma Interferon Test, Stat Pack Rapid Assay and others. These, either singly or in conjunction with each other, may give visibility to the situation, but the application of the skin test in camels has failed reliably to predict which animals are diseased. It is very important to understand that these tests are ONLY confirming that the immune system warriors are ‘on the case’. The outcome of the forthcoming battle is far from predictable.

One of four things may happen depending upon the ‘Operational Readiness’ of the APCs, and the level of challenge which, in turn, reflects upon your herd Management and Health Plan which should have maintained them in fighting condition. Their ‘Rules of Engagement’ are simple and ‘Dalek’-like – ‘Exterminate …Exterminate …’
1. Warriors, fighting on behalf of a fit, well-resourced host may be totally successful in countering the invader and eliminate it completely.

2. Warriors fighting on behalf of a totally compromised host will do their very best but may only be capable of offering token resistance, allowing the mycobacterium to dominate the battle field – the outcome is death of the host.

3. Warriors in an overstretched state may manage to focus exclusively on containing this particular mycobacterium and become the ‘prison warders’, locking it up in its own prison cell.

4. Warriors in a ‘Lock-up’ impasse may be good for just as long as there is not a conflict of interest. If they are sent off to fight another invader, they may be over-stretched, then a ‘prison breakout’ may occur. The results are clinical illness and death.

On an individual animal basis, the clinical (visible) signs that our ‘warriors’ are having an easy or tough time are few and far between. My ‘Over the Gate’ assessment may assist in recognising the latter.

**TB Ports of Entry**

Alpacas are nasal breathers, who only breathe by mouth in a state of distress; they exhibit a tendency to panic if their nasal passage is obstructed by, for example, ill-fitting halters:


It would logically follow that if an alpaca inhales a contaminant, in this case bTB, it will end up in the lungs, whilst for one that eats a contaminant, it will end up in the stomach.

![Sharing contaminated Air](image1)

Sharing contaminated Air

![Sharing contaminated Food](image2)

Sharing contaminated Food

In 1998, a group of llamas in Canada were deliberately infected with bTB using a direct injection of bTB isolate into the wind pipe to establish that the skin test would correctly identify animals which had mounted an immune response.


In this study it was proposed that the skin tests were to be taken at Post Infection (PI) = +120 days and again at PI = +180 days, followed by slaughter to evaluate the progression of bTB.
At PI = +62 days, the first animal was clinically compromised, coughing blood and losing condition and died at PI = +68 days. Another report indicates that, as the digestive tract has more defence mechanisms and a thicker lining then the airways, it may take approximately 5,000 to 10,000 times more *M. bovis* bacteria to infect an animal by ingestion then it does by respiration. In this situation, at the 68 days point the animal may be happy as Larry, things are under control, but nevertheless an immune response will have been initiated and, in theory, may be detectable by the current test methods.

http://www.gov.mb.ca/agriculture/livestock/anhealth/jaa04s03.html

**TB Control**

As we have seen, TB has been around for quite some time but by giving attention to denying it the optimum environment to replicate and reduce the number of carriers, be they cattle, wild deer, foxes, badgers or camels, it can be brought under control, as has been demonstrated in the human population. The statistics from UK Agriculture:

http://www.ukagriculture.com/livestock/tuberculosis.cfm

This shows that the Testing Rate of farm animals was under a slow decline and the slaughter rate steady until 1993. Then notice a small but steady increase. Something was happening. Some say it was due to:

http://www.opsi.gov.uk/ACTS/acts1992/ukpga_19920051_en_1

Then, in 2001, the testing regime all but halted to focus on the Foot and Mouth (FMD) epidemic. Since that time, the herd breakdowns, testing rate and slaughter rate have mounted inexorably.
TB Vaccination

On the face of it there would appear to be a good argument to support a TB vaccination programme, but the current vaccine bacillus, Calmette – Guerin (BCG), has an effectiveness which ranges from 0% to 80% in humans, cattle and, presumably, badgers.

http://www.jenner.ac.uk/vaccine_prog_bovinetb.html

(Cartoon by Ken Wignall.)

It also confusing the picture when it comes to testing, as it is not possible, at least in the field, to detect the immune response to BCG as opposed to the real thing. It's probably not for the want of trying; a considerable amount of money has been spent:

http://www.theyworkforyou.com/wrans/?id=2009-12-07a.303622.hf

Treatments for bTB

This raises the spectre of Drug Resistance. The first was Streptomycin, It was effective until a TB developed a resistant strain. The consequence was the need to develop replacements with the capacity to inhibit resistance. Along came isoniazid, rifampin and ethambutol.

If considered, it takes a dedicated regime, possibly for a year, using all three types to be anywhere near effective. If the course is cut short or otherwise compromised, it may produce yet another mutation of bTB. In some countries the use of these treatments is illegal. Indeed the outcome is not always positive

http://www.jstor.org/pss/20095043

The requirement is then for even more aggressive formulations such as ethionamide, proionamide, pyrazinamide, cycloserine, capreomycin or viomycin

Use of them on animals will effectively result in extensively drug-resistant (XDR) tuberculosis.

Richard Vickery

20 December 2009
What to look out for
Possible Signs and Symptoms of TB

Symptoms can vary dramatically in cases of TB in camelids, from severe to no symptoms at all. Monitoring your herd closely will very often give you signs of problems even though they are subtle. The earlier you detect signs of TB, the lower the risk to your remaining animals.

Not all alpacas have what is classed as ‘normal behaviour’ so:

ANY CHANGE IN THE INDIVIDUALS USUAL BEHAVIOUR OR DEMEANOUR is cause for concern. For example – if one of you herd usually kicks up a fuss at having toe nails/injections done and suddenly is compliant – that is what constitutes a change in usual behaviour.

Other symptoms and signs are as follows. These are based on information provided by 20 owners who have had, or still have, TB in their herds.

- Sitting more than normal; sitting when others are eating
- Lethargy
- Stiffness
- Groaning sounds when kushed
- Boisterous or first in the queue for food suddenly becomes subdued and not so pushy
- Continuous humming
- Foaming at the mouth
- Nibbling at grass/hay rather than eating hearty mouthfuls
- From a distance appears to be eating grass, but is in fact just mouthing it
- Decreased appetite or stopped eating
- Increase in appetite (very common, believe it or not)
- Nasal discharge – runny eyes
- Coughing
- Grunting/groaning noises
- Weight loss but normally at the severe stages and near the end. Some have no weight loss
- Unsteady on the legs
- Slow at rising and kushing
- Hiccups
- Continuous flared nostrils
- Very loud swallowing sounds
- Look of general discomfort
- Normal respiration rates are 15–30 breaths per minute. Be concerned at anything above 40 breaths per minute
- Breathing taking longer to return to normal after exertion.

We are not saying if your animals have these symptoms it is TB – it could be many other things. It is better to err on the side of caution. You have nothing to lose by removing these animals from the group with a mate and seek veterinary advice, but you have a lot to lose if it turns out to be TB and you didn’t take action.

It is recommended to remove any alpaca, along with a mate, that is showing any of the above signs and seek veterinary advice and do not return it to the group until normal behaviour returns or symptoms have cleared up.

Don’t forget your gut instinct – it is often right.

Dianne Summers, BAS TB Action Group
Alpacas & Other Camelids Biosecurity Checklist

This exercise is designed to highlight some of the areas that you can address to improve both your on-farm biosecurity and animal husbandry. These measures on their own cannot prevent TB or any other disease being introduced into your herd; however, they will help to demonstrate that you have considered all possible risks and have done what you can to prevent or minimise the chance of disease entering your premises. It will also help you reduce the spread of disease in your herd should you be unfortunate enough to introduce it. It is a guide only.

Answer all of the questions below as they relate to your herd, circling the answers as you go. If any question is not applicable to your holding, score this as one. Total your scores at the end.

- A score of 31 to 36 is excellent and you are doing almost all that you can to minimise your risks of introducing disease into your herd. Don’t rest on your laurels though, as biosecurity is an ongoing action that needs to be constantly monitored and delivered.
- A score of between 37 and 53 indicates that there are plenty of areas which should be improved.
- A score of more than 53 indicates that you have a long way to go before you can state that you are doing your utmost to minimise the introduction of disease onto your farm.

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Score 1</th>
<th>Score 2</th>
<th>Score 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Do you buy in replacement stock and check theirTB status before purchasing and do you know if TB is a problem in the area from which you are purchasing?</td>
<td>Always check it</td>
<td>Occasionally check it</td>
<td>Never check it</td>
</tr>
<tr>
<td>2</td>
<td>If you send your animals to stud, do you know the TB status of the premises or the area from which you are buying your service?</td>
<td>Always check</td>
<td>Occasionally check</td>
<td>Never check</td>
</tr>
<tr>
<td>3</td>
<td>If you have you lost any of your stock to illness or disease, have you had them post-mortemed?</td>
<td>Yes – all post-mortemed</td>
<td>Some</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>Do you isolate animals that have tested Btb positive immediately to reduce cross infection? Inconclusive reactors &amp; close contacts should be isolated as well until tested clear. Ensure that there is no nose to nose contact and that they are not within spitting distance of other animals whilst in isolation?</td>
<td>Always</td>
<td>Only if I have spare room</td>
<td>Never</td>
</tr>
<tr>
<td>5</td>
<td>Do you comply with the BAS Quarantine Policy, ensuring that new stock and animals returning to your farm are quarantined for the correct duration (currently 6 months)?</td>
<td>Yes, always</td>
<td>When it suits</td>
<td>Never</td>
</tr>
<tr>
<td>6</td>
<td>Do you isolate every sick animal until it has either fully recovered or has been seen by a Vet and cleared as safe and fit to return to your herd?</td>
<td>Yes, always</td>
<td>Sometimes</td>
<td>Never</td>
</tr>
<tr>
<td>7</td>
<td>Do you have badgers living close to or under your sheds, feed stores or other farm buildings?</td>
<td>No</td>
<td>Don’t know</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Question</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>8</td>
<td>Do you see emaciated or sick-looking badgers close to your sheds or feed stores seeking food?</td>
<td>Never</td>
<td>Occasionally</td>
<td>Regularly</td>
</tr>
<tr>
<td>9</td>
<td>Do you know what the Badger Act 1992 allows you to do if you find diseased, sick or badly injured badgers on your farm?</td>
<td>Yes, definitely</td>
<td>I think so</td>
<td>No</td>
</tr>
<tr>
<td>10</td>
<td>Do you ever see badgers wandering about in broad daylight?</td>
<td>Never</td>
<td>Occasionally</td>
<td>Regularly</td>
</tr>
<tr>
<td>11</td>
<td>Do you have access holes in your barn/feeder store walls that could allow a badger to access them?</td>
<td>None</td>
<td>Some</td>
<td>Lots</td>
</tr>
<tr>
<td>12</td>
<td>Are your feeders, water troughs and salt licks at ground level, giving easy access to wildlife? Troughs should be at least 30 inches (although Defra recommend 48 ins) above ground level?</td>
<td>None at ground level</td>
<td>Some</td>
<td>All</td>
</tr>
<tr>
<td>13</td>
<td>Are your barns, feeder stores and clamps badger-proofed? Are all access doors no more than 4 ins off of the ground?</td>
<td>All 4 ins or less gap</td>
<td>Some 4 ins or less gap</td>
<td>None are less than 4 ins gap</td>
</tr>
<tr>
<td>14</td>
<td>Have you fenced off known badger latrine areas to ensure your stock do not have access to them?</td>
<td>All</td>
<td>Some</td>
<td>None</td>
</tr>
<tr>
<td>15</td>
<td>Do you avoid mowing known badger latrine areas and using it as silage?</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Do you remove fallen stock quickly?</td>
<td>Always</td>
<td>Sometimes</td>
<td>Never</td>
</tr>
<tr>
<td>17</td>
<td>If you use electric fences to reduce access to badgers, do you always ensure that they are switched on and are working at the end of each working day? (Do you also make sure that the animals can’t get tangled up in the electric fencing ?)</td>
<td>Always</td>
<td>Sometimes</td>
<td>Never</td>
</tr>
<tr>
<td>18</td>
<td>Do you spread slurry or manure that originated from other farm premises, especially farms under TB restrictions ?</td>
<td>Never</td>
<td>Occasionally</td>
<td>Regularly</td>
</tr>
<tr>
<td>19</td>
<td>Do your animals have nose to nose contact with your neighbours stock? Potentially a huge risk if there is a known TB problem locally?</td>
<td>No, they don’t</td>
<td>Occasionally</td>
<td>Regularly</td>
</tr>
<tr>
<td>20</td>
<td>Do you check your boundary fences and repair them when necessary?</td>
<td>Regularly</td>
<td>Occasionally</td>
<td>Never</td>
</tr>
<tr>
<td>21</td>
<td>Where a common water source exists, that passes through other farms; do you prevent your stock from gaining access? Always use mains water if possible</td>
<td>Yes</td>
<td>Only in part</td>
<td>No</td>
</tr>
<tr>
<td>22</td>
<td>Do you house your animals indoors overnight? Infected badger urine is potent during darkness. (We are aware that most camelids do not like to be housed overnight)</td>
<td>Always</td>
<td>Sometimes</td>
<td>Never</td>
</tr>
<tr>
<td>23</td>
<td>Do you have a pest control programme, locally or professionally delivered, and use it effectively?</td>
<td>Yes, regularly</td>
<td>Occasionally</td>
<td>Never</td>
</tr>
<tr>
<td>24</td>
<td>Do you check your internal feed troughs for wildlife faeces/urine and clean them regularly?</td>
<td>Yes</td>
<td>Sometimes</td>
<td>Never</td>
</tr>
<tr>
<td>25</td>
<td>Do you ground feed your stock whilst at pasture?</td>
<td>No</td>
<td>Occasionally</td>
<td>Regularly</td>
</tr>
<tr>
<td>26</td>
<td>When sharing farm machinery, or hiring it in, do you always insist that it is clean &amp; disinfected before it arrives?</td>
<td>Always</td>
<td>Sometimes</td>
<td>Never</td>
</tr>
<tr>
<td></td>
<td>Question</td>
<td>Column A</td>
<td>Column B</td>
<td>Column C</td>
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<td>---------------</td>
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<td>------------------------</td>
</tr>
<tr>
<td>27</td>
<td>Do you ensure that every visitor to your premises disinfects before allowing them access to your animals? Foot wash and hand wash are both needed.</td>
<td>Always</td>
<td>If I remember</td>
<td>Never</td>
</tr>
<tr>
<td>28</td>
<td>Do you have a Herd Health Plan that has been devised and agreed with your Vet?</td>
<td>Yes and I use it</td>
<td>Have it but don’t always use it</td>
<td>I don’t have one</td>
</tr>
<tr>
<td>29</td>
<td>Did you know that bovine TB is a zoonotic disease that can be caught by humans? Do you understand the implications of a zoonotic disease being present in your herd?</td>
<td>Yes</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>30</td>
<td>Did you know that wire boundary fences should be double wired, at least 10 feet apart, to deter nose to nose contact with neighbouring stock and to minimise spitting contacts?</td>
<td>Yes</td>
<td>Had an idea but not too sure</td>
<td>No</td>
</tr>
<tr>
<td>31</td>
<td>Would you recognise signs of disease in your animals? Listless, off their food, lying down more than normal, weight loss, abnormal behaviour etc</td>
<td>Yes</td>
<td>Probably</td>
<td>No</td>
</tr>
</tbody>
</table>

Biosecurity is not measurable in terms of money being well spent or not. It can, however, be assumed that if you have taken all of the above measures seriously and that you don’t have disease when others do, you may well have avoided it due to the biosecurity measures you implemented. Furthermore, the piece of mind it gives you is immeasurable, especially if you do ever succumb to bovine TB or any other serious disease – just ask those who have had the huge misfortune of having lost their animals to bTB or any other disease. Thinking about what you should have done is too late once you have the disease. Preventative actions are always better than a cure.

Active animal husbandry is a must if you are serious about keeping your animals healthy. Clean food, clean water, clean sheds and bedding, clean paddocks, regular health checks, etc, all assist in the 'added value' factor of your animals so, if for no other reason, carrying out animal husbandry does pay.

CONTACTS – if we can be of service to you or you would like to find out more, please get in touch via:

e-mail at: **FSSWADMN@AOL.COM**

Business Tel: 01872 241521; Mobile: Paul Caruana 07866 303405; Graham Hutton 07813 588309

or write to us at: 13, Murdoch Close, Truro, Cornwall TR1 1RR
TB Tests Currently Available in Camelds – January 2010

Gina Bromage, MA, Vet MB, DVM, MRCVS

In the context of testing animals for TB it is important to remember that TB is a notifiable disease. That means that if it is suspected or diagnosed, the government must be informed, via the Animal Health Department. All tests are therefore controlled and administered by government agencies; none are available privately. If animals are tested at an owner’s request, Animal Health requires that it is informed of the results.

Comparative Intradermal Skin Test ('The Skin Test')

This test has been adapted from cattle, where it is the legally accepted screening test. It demonstrates (as do all of the currently existing tests) only that a reacting animal has been exposed to TB infection. It does not distinguish between ill, infectious, vaccinated or immune animals.

How is it done?

On Day 0, all animals have a fold of skin of the left axilla ('armpit' where there is no fleece) measured for thickness, then have 0.1 ml bovine tuberculin injected into the thickness of the skin at a marked site. This procedure is repeated on the right, using avian tuberculin.

The reason for using both types of tuberculin is that avian TB, which is not a notifiable disease, is well recognized in cattle, and infection with it can cause an animal to react to the bovine test. Therefore the size of the reactions are compared: if the animal is exposed to avian TB, the reaction on the avian side is larger than that on the bovine side. If the reactions are the other way round, with the bovine one being larger, then it is exposed to the bovine infection, a 'reactor'.

On Day 3 (72 hours later), the skin thickness at the injection sites is measured again. An increase in thickness denotes a reaction. If there is an increase in thickness on the bovine site which is more than 2 mm greater than any increase on the avian site, the animal is a reactor, and Animal Health will ask for it to be culled. If there is an increase, but less than 2 mm larger than that on the avian side, then the animal is isolated and placed in a 'watch' group.

Sensitivity and Specificity – How Accurate is the Test?

Sensitivity refers to the ability of a test to detect an animal with the disease. A test which was 100% sensitive, would never miss an animal which had the disease, ie, never gives false negative results.

Specificity refers to the ability of the test not to falsely accuse a healthy animal of having the disease. A test which was 100% specific would never say an animal had the disease if it did not, ie, would never give false positive results.

The skin test seems to be close to 100% specific in camelids, so if results are positive they almost always have TB, but at best it is only up to 20% sensitive, so that if results are negative it doesn’t mean that the animals are clear, because upwards of 4 out of 5 diseased animals will be missed by the test.

In cattle, the levels of sensitivity and specificity are adequate gradually to clear an infected herd, as long as the source of infection has been eliminated. In camelds, this is not the case and in a number of documented instances, a herd has tested clear for the second time, only to have an animal die of the disease within days, indicating that the test failed to pick up both early and advanced disease. The other problem in camelid herds is that it appears that once an individual has the disease, it readily spreads it to other herd members in a way which seems to happen less often in cattle. The result is
that by the time the first animal actually dies, a large proportion of the companion group may have contracted the infection.

The skin test is used in camelids because it is the legally accepted screening test. Although Animal Health recognises its limitations in these species, it is stuck with it because it is enshrined in EU legislation as part of the protocol for dealing with TB outbreaks. Since EU legislation is not going to change in a hurry, we have to work with this test. The legislation requires a farm to have two clear skin tests at 90 days and 180 days after the last TB diagnosis before it is declared to be clear of infection.

NB. See the Animal Health leaflet on the correct procedure for the administration of the skin test in camelids. It is different from the cattle procedure and, if not properly conducted, will be even less accurate than usual.

The Other Tests – All Blood Tests

There are three other tests which have been used to screen for TB infection in camelids. All three are still in development, but two of them have been used on a trial basis at the discretion of Animal Health. The Rapid test and the Camelid Specific Gamma Interferon test may be offered to owners with diagnosed infection on their farms, but only after the skin test has been performed.

Chembio Rapid Stat Pak Test

This test uses the principle of detecting certain proteins in the blood, which show the animal has mounted an immune response to TB. Data are still being collected to validate it in terms of sensitivity and specificity, but it does seem to be more sensitive than the skin test, although possibly less specific.

Camelid Specific Gamma Interferon Test

This test is very new, and is an adaptation from the cattle interferon test; the cattle test itself does not work in camelids at all. The camelid-specific test uses camelid proteins instead of bovine ones and, although it is very new, also shows some promise. Like the Rapid test, data are still being collected for its validation.

Multi Antigen Print Immunosorbent Assay (Mapia) Test

This test uses many proteins in an array to detect evidence of immune response to TB. It seems to be the most accurate of the three on the (limited) published data, but it is really only an experimental test which is looking for the best proteins on which to concentrate a commercial test. As such, it would be too cumbersome to use on large numbers of animals.
10. TB in South American Camelids (llamas, alpacas, vicuñas, guanacos)

Background
10.1 TB is not a major health problem of camelids, but these species do occasionally become infected and develop clinical TB. Although reports of infection in their natural habitat in South America are few, cases of TB caused by *M. bovis* have been diagnosed in llamas and alpacas in New Zealand, the USA, Holland, Ireland and Great Britain, some of them with high morbidity and severe disease. *M. avium* and *M. microti* infections have also been documented in the veterinary literature. The disease is very difficult to diagnose on clinical examination. Some authors suggest that TB should be considered in the differential diagnosis of all cases of chronic loss of condition in these species, with or without obvious respiratory signs.

Procedures
10.2 As with other non-bovine species, there is at present little legislation underpinning the control of TB incidents in camelids in Great Britain, apart from the general power in the TB Orders to isolate and restrict movements of any affected and in-contact animals. There is no requirement to identify camelids or record their movements. DVMs or Local Authorities have no legal powers to enforce tuberculin testing of camelids and slaughter any reactors. Similarly, there are no provisions to compensate owners for the loss of such animals. Therefore, any testing of camelids for TB has to be voluntary, but if the owner does agree to test at the Department’s expense (see below), then this needs to be linked to a voluntary prior agreement to release for slaughter any animals identified as reactors. 10.3 Camelids will be tuberculin skin tested at the Department’s expense if:

- infection with *M. bovis* of the camelid herd itself is confirmed by bacteriological culture;
- identified as forward or back tracings from a herd with confirmed *M. bovis* infection;
- *M. bovis* infection has been confirmed in a cattle herd co-located with (or contiguous to) a camelid herd.

10.4 In the first situation described in 10.3 above (i.e. where *M. bovis* infection has been confirmed in a camelid herd), Article 18 (17 or 16, as applicable) restrictions TR148 will be served and remain in place until the DVM is satisfied that the herd is free from TB. In practice, this means that the movement restrictions can only be rescinded once all infected and any test-positive animals have been slaughtered and any remaining animals have undergone two consecutive intradermal comparative tests with negative results at intervals of 90 days or more. 10.5 Alternatively, the whole herd in which *M. bovis* has been isolated may be privately slaughtered or, if the owner does not give permission to test, remain under permanent restrictions. 10.6 Where a camelid herd is co-located with an infected cattle herd on the same TB2 restricted premises and infection has not been demonstrated on the camelids themselves, Notice of restrictions TR148 should be served as a precaution but lifted once TB2 has been withdrawn from the infected cattle herd and the entire camelid herd has undergone one tuberculin test with negative results.

10.7 The CCDC should not be notified in the case of co-located camelids, unless/until *M. bovis* infection has been confirmed in the camelids, although they should already be aware that there is confirmed TB in the cattle herd anyway. The presence of camelids in itself does not materially alter the public health risks arising from the ongoing situation in the infected cattle herd.

10.8 Whenever the need has arisen in the first place to test camelids, goats (or any other livestock) located on the same premises as infected cattle, the cattle TB2 restrictions cannot be lifted unless the goats, camelids, etc. have also been TB tested with negative results, or control measures had been adopted by the owner to effectively segregate the cattle from the untested animals on the same farm before commencement of their short-interval testing regime. 10.9 If the owner refuses to test the camelids on farm, the decision as to whether the restrictions should remain in force or be withdrawn when the TB10 is served on the cattle herd, should be taken as per DVM discretion based on the risk-assessment of the management of the two species on the affected farm, the likely source of infection for the cattle herd and the potential routes of transmission. 10.10 Co-located in this context involves occupation of the same holding as the infected cattle herd with potential for direct or indirect contact between cattle and camelids or exposure to a common source of *M. bovis* infection.
10.11 Camelid herds that are contiguous to a confirmed cattle breakdown or individual camelids/herds identified as forward/back tracings from an *M. bovis*-infected camelid herd should not, in principle, be subjected to Article 18 restrictions TR148 while they await TB testing.

**Testing/Sampling**

10.12 Tuberculin testing of camelids will be by the single intradermal comparative cervical tuberculin (SICCT) test in the **posterior axillary region**. Although not fully validated in camels, the SICCT test is adequate for assessing the status of individual camelids in a herd with confirmed TB. This test provides reasonable sensitivity and specificity if meticulously performed. The SICCT is also the official testing procedure for camelids exported from the UK and has been officially adopted by the Swedish Board of Agriculture and the Swiss Federal Veterinary Office as the recommended test for TB in camelids. Intradermal tuberculin tests in the posterior axillary site are also the prescribed tests for TB in camelids in the USA (Animal and Plant Health Inspection Service, US Department of Agriculture), Argentina (SENASA – National Food Hygiene and Quality Service), New Zealand (Alpaca Association of New Zealand) and Canada (Canadian Food Inspection Agency).

10.13 To date, no alternative in vitro diagnostic methods for bovine TB have been properly validated in sufficient numbers of camelids. The recently developed Chembio Rapid Test is available at VLA on an experimental basis. This blood test is based on the detection of antibodies to a set of recombinant *M. bovis* antigens and is known to detect tuberculous animals of a range of species. Experience from badgers and cattle indicates that the Rapid Test has good specificity but a moderate sensitivity. It can be used as a voluntary ancillary parallel test of skin test-negative animals in camelid herds with confirmed infection to enhance the overall sensitivity of TB testing, ideally after the initial skin herd test. Approval for this test must be obtained in advance from Veterinary Services Manager in Policy and Planning and, if granted, blood samples are to be taken 10-30 days after a skin test. Further information can be found at: Sample, Test & Result > Diagnostic Testing. VLA does not offer the Rapid Test on a private basis to owners of camelids. The γ-IFN test (Bovigam®) for TB does not work in camelids.

10.14 Where TB testing is being carried out at the Department’s expense, an ex-gratia flat payment may be available for each reactor, subject to a risk assessment by Animal Health which concludes that infection in the camelid herd poses a risk for animal and/or human health in the locality and payment would encourage the removal of potentially infected animals. Please check with the relevant VSM of Policy and Planning before committing to any payments with the owner. Once there is agreement in principle from both sides to TB test, it is advisable that Animal Health obtain the owners’ written confirmation of their acceptance of an ex gratia payment for any reactors, at least before undertaking a herd test.

10.15 The SICCT test in camelids should ideally be applied by a VO. Failing that, the test, in decreasing order of preference, can be applied by:

- an OV in the deer testing panel;
- an OV with experience of testing camelids for export;
- a camelid experienced OV.

10.16 For these options a VO will need to attend and supervise at least the start of the test to ensure testing protocols are clear and for Animal Health to gain knowledge of camelids.

10.17 The protocol and interpretation that must be adopted is set out in detail see: Sample, Test & Result > Sample & Test Techniques > The Tuberculin Testing of Camelids.

### HEALTH AND SAFETY WARNING

Unlike cattle, camelids can spit a mixture of gastric contents and saliva. This is a potential zoonotic risk. Please take appropriate health and safety precautions (see Chapter 46 for details).

10.18 Tested camelids will be considered potentially infected (reactors) if a positive reaction (i.e. >2mm increase or detectable oedema) is observed at the bovine tuberculin injection site 72 (± 4) hours after injection and the increase in skin thickness at the bovine injection site exceeds that measured at the avian injection site. Any other animals will be considered negative. Test results should be recorded on the standard cattle test charts TB52(LT)/TB52(VI), TB52A(LT)/TB52A(VI) and submitted promptly to the DVM. If a camelid fails the skin test, the whole herd will be placed under Article 18 or 17 or 16 restrictions if not already in force.
TB restrictions will remain in force until all test reactors have been slaughtered and undergone post-mortem examination.

Further Action

10.19 Any camelids that may have moved out of an infected herd should be forward traced and tuberculin tested once at the Department’s expense. It is difficult to define a time window for forward tracings in the absence of any testing history for most camelid herds. Where the infection appears to be due to the purchase of infected stock, tracing investigations should span the period since the arrival of the infected camelid(s). By contrast, where the presumed origin of the TB incident is lateral spread into camelids from local cattle or wildlife source, then the window for forward tracings will be determined by the most likely date of exposure for the diseased camelid(s), based on pathological and epidemiological findings.

10.20 Testing of any forward-traced animal should take place at least 90 days after the animal left the infected flock. The test should be read using the same interpretation as set out in the previous paragraph. If the owners refuse to allow testing of traced animals, or if there is suspicion that the traced animal could be moved prior to testing, only the traced camelid should be placed under Article 18 or 17 or 16 restrictions TR148. The Notice TR148 should confine the traced animal to the premises and isolate it from other susceptible animals until slaughtered, tested clear or dead. In the absence of individual animal ID (i.e. where the current owner cannot conclusively identify which animals came from the infected herd), there may be no option but to check test the entire destination herd. Back tracing investigations and testing of the suspected herd(s) of origin of a tuberculous camelid should also be undertaken.

10.21 Consideration should also be given to testing camelid herds that are contiguous with cattle herds affected by confirmed TB breakdown, where the epidemiological investigation (DRF) reveals such herds and indicates that camelids might be a source of (or at risk of) infection. Again, this will be at the Department’s expense and with the owner’s agreement and understanding of the implications. 10.22 Finally, private tuberculin testing of camelid herds of unknown status at the owner’s request can be permitted provided that the owner is willing to pay an OV to perform the test. Animal Health will supply the necessary tuberculin free of charge. The OV doing the test will need to write the results up on the usual TB52(LT)/TB52(VI), TB52A(LT)/TB52A(VI) forms and send those to the DVM. Animal Health must inform the herd owner, in advance of testing, of the possible repercussions of a positive test result (e.g. herd restrictions).

10.23 The movement licence [TR219] should be used to authorise all movements direct to slaughter.

10.24 The withdrawal of restrictions notice [TR220] should be used to lift restrictions when appropriate.
Defra Animal Health Tuberculin Skin Testing Procedure

16. The Tuberculin Testing of Camelids
16.1 Tuberculin supplied for testing cattle can be used for camelids. 16.2 There are similarities to testing in deer but for camelids the vet does not need to be on the deer testing panel (although this would be desirable). 16.3 Tuberculins (0.1 ml) should be injected intradermally on the right (avian) and left (bovine) sides of the thoracic cage in the axilla. This area generally has no or very little fibre, so the injection sites may not need to be clipped or shaved before the skin thickness is measured and the tuberculin injected. If the animals have no eartags, tattoos or other permanent markings, they can be identified for testing purposes using temporary (e.g. spray) marks.

Equipment
16.4 The equipment required varies from that listed in the Tuberculin testing instructions for cattle in the following details:

- instead of dental or McLintock syringes, disposable 1 ml syringes graduated 0.1 cc and fine needles 25/26G needles should be used. The syringes to be used for avian tuberculosis should be marked with red tape;
- engineer’s (Vernier) callipers or the equivalent (as for deer), which are calibrated to measure accurately to at least 0.5 mm must be used by the testing vet for all officially requested tests and must be strongly recommended to all other vets carrying out private tests;
- marker pens will be required to mark the test sites;
- sharps container for used needles, etc.

Test Technique

- Syringes and needles must be sterile before use.
- Mark the injection sites with the marker pen as shown in the diagram.

16.5 Raise a fold of skin at each site, measure accurately with the callipers and record the measurement to the nearest 0.5 mm. 16.6 To achieve as uniform a standard of measurement as possible the following measurement technique should be adopted:

16.6 To achieve as uniform a standard of measurement as possible the following measurement technique should be adopted:

16.7 The calliper jaws should be aligned with the fold of skin as shown in the diagram above.
16.8 Measurements will be influenced by skin tension, by the amount of pressure placed by the callipers and by the amount of skin picked up for measurement. Make every effort to standardise the conditions for both injections and readings.

- Draw 0.1 ml of tuberculin into the appropriate syringe. Insert the 25/26 gauge needle with the bevel edge outwards obliquely into the prepared area.
- Make the injection of 0.1 ml of the appropriate tuberculin so that it is lodged intradermally and check that a pea-like nodule is palpable.
- If such a nodule is not present and it is likely that the tuberculin has been injected subcutaneously, a further injection should be made in the same axilla 8-10 cm away (3 to 4 inches).
- Re-measure the fold of skin at each site after 72 hours and record again to the nearest 0.5 mm along with description of the reaction.
- During testing it is important that needles should be changed frequently as they can become blunt very quickly.

HEALTH AND SAFETY WARNING
Unlike cattle, camelids can spit a mixture of gastric contents and saliva. This is a potential zoonotic risk. Please take appropriate health and safety precautions (see Chapter 46 for details).

Reading and Interpretation

16.9 Tested camelids will be considered potentially infected (reactors) if a positive reaction (i.e. >2 mm increase or detectable oedema) is observed at the bovine tuberculin injection site 72 (± 4) hours after injection and the increase in skin thickness at the bovine injection site exceeds that measured at the avian injection site. Any other animals will be considered negative. Test results should be recorded on the standard cattle test charts (TB52(LT)/TB52(VI), TB52A(LT)/TR52(VI)) and submitted promptly to the DVM. If a camelid fails the skin test, the whole herd will be placed under Article 18 or 17 or 16 restrictions if not already in force. TB restrictions will remain in force until all test reactors have been slaughtered and undergone post-mortem examination.

16.10 Any camelids that may have moved out of an infected herd should be forward traced and tuberculin tested once at the Department’s expense. It is difficult to define a time window for forward tracings in the absence of any testing history for most camelid herds. Where the infection appears to be due to the purchase of infected stock, tracing investigations should span the period since the arrival of the infected camelid(s). By contrast, where the presumed origin of the TB incident is lateral spread into camelids from local cattle or wildlife source, then the window for forward tracings will be determined by the most likely date of exposure for the diseased camelid(s), based on pathological and epidemiological findings. Testing of any forward traced animal should take place at least 90 days after the animal left the infected flock. The test should be read using the same interpretation as set out in the previous paragraph. If the owners refuse to allow testing of traced animals, or if there is suspicion that the traced animal could be moved prior to testing, only the traced camelid should be placed under Article 18 or 17 or 16 restrictions. The notice to restrict movements onto or off the premises should confine the traced animal to the premises and isolate it from other susceptible animals until slaughtered, tested clear or dead. In the absence of individual animal ID (i.e. where the current owner cannot conclusively identify which animals came from the infected herd), there may be no option but to check test the entire destination herd. Back tracing investigations and testing of the suspected herd(s) of origin of a tuberculous camelid should also be undertaken.

16.11 Consideration should also be given to testing camelid herds contiguous with cattle herds with a confirmed TB breakdown, where the epidemiological investigation (DRF TR150) reveals such herds and indicates that camelids might be a source of (or at risk of) infection. Again, this will be at the Department’s expense and with the owner’s agreement and understanding of the implications.

16.12 Private tuberculin testing of camelid herds of unknown status at the owner’s request can be permitted provided that the owner is willing to pay an OV to perform the test. Animal Health will supply the necessary tuberculin free of charge. The OV doing the test will need to write the results up on the usual TB52(LT)/TB52(VI), TB52A(LT)/TR52(VI)forms and send those to the DVM. Animal Health must inform the herd owner, in advance of testing, of the possible repercussions of a positive test result (e.g. herd restrictions).

16.13 Further guidance on the investigation and reporting procedures for cases of tuberculosis in camelids can be found at: Disease Investigation > Disease Reporting Procedures > TB in South American Camels.
Biosecurity Recommendations for UK Camelid Farmers

British Veterinary Camelid Society

Given the recent emergence of several infectious diseases in the UK and the unknown effects of these diseases on South American camelids, it seems prudent that camelid breeders take stock of their approach to biosecurity. This may mean changing some existing practices, but the benefits of avoiding contact with disease should far outweigh any inconveniences faced. Members of the British Veterinary Camelid Society have put these recommendations together.

The aim of “biosecurity” is to prevent the introduction and spread of disease in susceptible populations or herds of animals. Mainly we are talking about viruses, bacteria and parasites. Below is a list of potential diseases and organisms that may be spread from animal to animal:

- gastrointestinal parasites
- coccidia
- bacterial pathogens, eg, Strep zoopneumonia, salmonella
- TB
- Johne’s disease
- viruses, eg, llama adenovirus, respiratory viruses, equine herpes virus
- bovine viral diarrhoea virus?
- foot and mouth disease?
- bluetongue?

For the last three viral diseases, the pathogenesis of potential disease in camelids and the effects of these viruses in terms of causing clinical disease in our species is largely unknown. Further research is needed, but in the meantime, it would be prudent to include them in biosecurity considerations to try and minimise their effects.

Essentially, biosecurity means protecting your existing herds from exposure to disease that may be brought in by new animals, while also minimising exposure to potential pathogens (disease-causing agents) that already exist on the farm. It is important to understand that animals may be “clinically normal” and showing no signs of disease while actually either incubating disease or being sub-clinically affected: for example, shedding coccidia although not having diarrhoea.

Therefore, it is not adequate merely to exclude animals that appear to be unhealthy as those that appear healthy – and may have passed veterinary health examinations – may still introduce disease onto your farm. A veterinary health certificate only shows that the animal appeared to be healthy at the time of the examination and does not certify the animal as free from disease.

It is also important to realise that the stress of moving animals from one farm to another, attending shows, changes in environmental conditions and social status can cause immune system suppression such that an animal that was previously healthy may be more susceptible to development of disease. For example, it is quite common for an animal to have a negative faecal evaluation for parasites prior to transportation, and then several weeks later to find that the same animal has a clinically significant parasite burden. Commingling of animals at shows or while visiting breeding farms increases the potential exposure of animals to disease while also causing a certain degree of stress-induced immunosuppression. For comparison, imagine a night spent on an aircraft travelling back from holiday – the effects of sleep deprivation (a stressor) suppress your immune system such that your body is less able to prevent the development of a cold from exposure to a cold virus breathed out by someone on the plane nearby.

We suggest following these practices:

1. Avoid introducing any animals that do not appear healthy to the rest of the herd.

2. Know the disease status of any herd from which you are buying animals, or where your animals are being temporarily housed. Ask about current health status on the farm, but also previous problems with
diseases such as gastrointestinal problems (diarrhoea, parasites...), respiratory disease, abortion, ill-thrift or failure of passive transfer. Knowing that a particular farm had a problem with diarrhoea for example is not necessarily a problem: knowing that the problem was identified, diagnosed and correct treatment and prevention measures employed should be reassuring and also shows that the farm knows what they are doing!

3 Isolate and quarantine all new animals before introducing them to the herd. This includes animals that have been to shows or off farm for breeding purposes since they have been commingling with other animals. If you are introducing solitary animals, you may need to place herd animals in the quarantine area to reduce the separation stress: choose less valuable animals for this such as geldings, avoid using breeding or lactating females.

a  Recommended quarantine period: 30 days. TB is unlikely to be disclosed by your routine quarantine period, however long this may be.

b  Operate an all-in, all-out policy such that all animals housed in the quarantine area leave quarantine at the same time. The quarantine period only starts from the time the last animal entered. Do not have animals moving in and out of the quarantine area on an individual basis.

c  The location of the quarantine site should be physically separate from the main herd as well as its handling facilities and housing. Ideally this should be several hundred yards away if possible and positioned such that it is downwind from the main herd, but at the very least, there should be a double fence line between the groups in order to prevent direct contact.

d  On a larger facility, have different staff working with the quarantine group and do not have the same staff return to the main herd. If this is not possible, tend to the main herd before tending to the quarantine group. Wear clothing and footwear that is dedicated to the quarantine group when tending to this group. These must be washable (eg, Wellies okay, suede or fabric workboots are not).

f  Monitor the animals in quarantine on a daily basis. Monitor attitude, appetite, water consumption, urination and defecation as well as for any signs of coughing, discharge from the eyes or nose, diarrhoea etc... Animals showing any signs of disease should be further separated from the rest of the animals in quarantine and evaluated by a vet.

g  Evaluate a faecal sample on entry to the facility, and again three weeks later. This will give ample time for treatment to take place.

4 Minimise exposure of the herd to visitors. If visitors come to the farm, question them about exposure to other livestock and where they have come from, and make sure that they come to the farm wearing clean clothes and boots. Provide visitors with overalls kept on the farm for this purpose and have Wellies available for their use if they do not come prepared. Make sure that hand-washing facilities are available.

5 Maintain optimum condition of animals in the herd. This will make them less susceptible to disease.

a  Monitor body condition on a monthly basis – over and under conditioning can cause problems.

b  Ensure optimal nutrition in terms of the feed and minerals that are provided. Mineral deficiencies can be responsible for disease problems in herds. Also, ensure that young growing stock receive sufficient vitamin D to prevent rickets.

c  Provide unlimited access to fresh clean water.

d  Provide protection from the elements: shade in summer and shelter from rain, wind, cold and snow in the winter. Appropriate bedding (egg straw) may also be necessary for protection from cold.

6 General cleaning and disinfection:

a  Personal hygiene to prevent transmission of pathogens between animals and from animals to humans (known as "zoonotic disease"):  
  – frequent hand washing with hot water and soap  
  – cleaning and disinfection of boots  
  – thorough washing of clothing used when caring for animals.

b  Disinfection requires surfaces to be clean. All organic matter (faeces, urine, milk, spit) must first be removed before disinfection can work on fences, floors, walls, clothing or hands. Disinfection may be difficult for certain organisms such as Cryptosporidia (which can also cause disease in humans) so is best avoided in the first place by following optimal biosecurity on the farm.

Reference:

Claire Whitehead, BVM&S, MS, DACVIM, MRCVS
<table>
<thead>
<tr>
<th>Areas checked</th>
<th>Findings</th>
<th>Recommendations &amp; comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrival &amp; departure – disinfectant in use</td>
<td>No disinfection process in place. Foot bowls were present but empty.</td>
<td>As a priority, reinstate the disinfection process at the entrance and consider additional footwash facilities into the main paddock. Recommend FAM 30 disinfectant is used.</td>
</tr>
<tr>
<td>Farm boundaries and fencing condition</td>
<td>Boundary fences were too close to the hedge and allowed nose-to-nose contact over it. Hedges were in poor condition and require reinstating in some areas.</td>
<td>Reinstate hedge on northern boundary and install secondary fencing at least 10 feet away from the boundary hedge. Your stock currently has nose-to-nose contact with your neighbour’s stock. Potential for some electric fencing to be installed to assist in keeping wildlife out. Installing some stock proof fencing (sheep wire) will help in this area. Allowing access to natural hedges can result in your stock reaching into the fox runs that exist. Sarcoptic mange infection is a real problem if you allow that to continue.</td>
</tr>
<tr>
<td>Wildlife activity found</td>
<td>A single hole badger sett was found on the Northern boundary hedge, with a latrine area beside it. A clear run, emanating from the sett, direct to the feed store exists. Another, much larger latrine area was found in the top paddock, which was easily accessible to your stock. Signs of lots of rabbits and numerous foxes on the premises.</td>
<td>The single hole badger sett needs close monitoring, as it may well contain a sick animal. Check your rights under the Badger Act to see what you can legally do if it is indeed sick. Suggest that electric fencing be used on the northern boundary hedge to deny entry to the badger. Consider fencing off the latrine areas with sheep wire or electric fencing as a matter of priority.</td>
</tr>
<tr>
<td>Occupant’s biosecurity awareness</td>
<td>Clearly not fully aware of the need for active biosecurity measures to be implemented.</td>
<td>I debriefed you on all of the areas that need to be addressed and I left our advice leaflet on the easiest, cheapest and most effective measures to adopt.</td>
</tr>
<tr>
<td>Housing &amp; shed conditions</td>
<td>The feed store has open access holes in its side which will result in badgers, rats and mice gaining access and possibly cross contaminating your feed. Animal shelters were well maintained but the bedding was very old and could do with regular replacement.</td>
<td>Repair and reinforce the side walls of the feed store as a matter of priority. Change the bedding regularly, as it will attract rats and mice and will possibly retain mange mites in it if you ever suffer with that particular problem.</td>
</tr>
<tr>
<td>Topic</td>
<td>Description</td>
<td>Recommendations</td>
</tr>
<tr>
<td>-----------------------------------</td>
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<td>----------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Water troughs</td>
<td>All were at ground level and easily accessible to other wildlife species.</td>
<td>As a matter of urgency, raise your troughs off the ground to a height of at least 30 ins. The badger living on the northern boundary is clearly using the trough closest to the feed store, possibly cross contaminating your water. Badger footprints were found all around the trough.</td>
</tr>
<tr>
<td>Ground feeding</td>
<td>Ground feeding was apparent.</td>
<td>Use the feed stands that already exist, as these will deter badgers from feeding on uneaten feed that your stock don’t consume. Badgers saliva and urine will infect ground feed if it is left uneaten.</td>
</tr>
<tr>
<td>Other pests/rodents found</td>
<td>Rat and mice droppings were clearly in evidence in your feed store.</td>
<td>Repair the feed store walls and get a Pest Control company to initiate a removal programme if you can’t do your own. Some self-help would also be beneficial, but beware of what poisons you use, especially with cats and dogs on the premises.</td>
</tr>
<tr>
<td>Signage</td>
<td>No obvious signs on display. If there were, we missed them.</td>
<td>Recommend that an 'All visitors to report to owner before entering the premises' sign be put on display to ensure unexpected visitors comply with arrival and disinfection procedures.</td>
</tr>
<tr>
<td>TB awareness generally</td>
<td>Wasn’t aware that there was a TB problem in cattle locally, and that you were open to the disease being introduced onto your farm via the wildlife that exists on it.</td>
<td>Stay informed. Speak to your neighbours on the matter and be vigilant at all times. Consider subscribing to your Society’s Newsletter or Magazine to stay informed.</td>
</tr>
<tr>
<td>Stock faeces removal</td>
<td>There were large amounts of faeces in all of the paddocks.</td>
<td>A faeces removal programme is necessary to both reduce risk of infection and to improve your animal welfare conditions.</td>
</tr>
<tr>
<td>Gate condition &amp; effectiveness</td>
<td>Where they exist, all were in good condition</td>
<td>None</td>
</tr>
<tr>
<td>Badger awareness</td>
<td>Not very knowledgeable on telltale signs to watch out for. With lots of foxes on the property, it would be easy to mistake fox activity with that of badgers.</td>
<td>Information given on the day. Photographs and other supporting information to be sent via e-mail. This will allow easy identification of badger activity as opposed to fox. You now know what a badger latrine area looks like.</td>
</tr>
<tr>
<td>Isolation paddock availability</td>
<td>You didn’t have one in place, but there were plans to erect one if a disease outbreak occurred.</td>
<td>Waiting for it to happen will create problems, as you will need it immediately when disease does arrive. A paddock, well away from your grouped stock area, is a matter of necessity. Ensure that you place a footwash bowl at the access to it as well. Disinfect into and out of it when you are using it for isolation purposes.</td>
</tr>
<tr>
<td>General knowledge on animal welfare and species habits</td>
<td>Seemed to be generally aware of the need for good animal husbandry and welfare but didn’t always put it into practice.</td>
<td>Time needs to be taken to ensure that your stock is well cared for. Prevention is always better than cure!</td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
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</tr>
<tr>
<td>Mapping availability</td>
<td>Farm boundary maps were not available or used for the survey. As a 50-acre holding, it is imperative that accurate maps are available to work with.</td>
<td>Recommend that every farm has a copy of the farm boundaries available for us to use and return to the owner once wildlife activity has been plotted on it.</td>
</tr>
<tr>
<td>Documentation left with owner</td>
<td>A question/answer biosecurity sheet, copy of the Badger Act 1992 and a copy of our TB information sheet was left with the owner</td>
<td>Photos to be sent as agreed with owner.</td>
</tr>
</tbody>
</table>

**GENERAL COMMENTS:** With many valuable animals on the property, care and action needs to be taken to reduce the possibilities of introducing disease onto it. Clearly, with the amount of badger activity found, coupled with the incidences of TB in cattle locally, there is a real possibility of introducing TB into your herd. You need to address your fencing, feed store, ground feeding, trough and badger latrine areas as a matter of priority. After those areas have been addressed, you need to go through this assessment sheet to determine what actions are needed to further minimise your chances of introducing and spreading disease.

*Note: For interest only.* The Public Footpath dissecting the farm will always have potential for introducing disease accidentally, and in times of high alert, actions should be taken to eliminate all possibility of public contact with your animals by means of good signage and possible closure of the footpath if the nature of the outbreak demands it.

**CONTACTS** – if we can be of service to you or you would like to find out more, please get in touch via:

e-mail at: [FSSWADMN@AOL.COM](mailto:FSSWADMN@AOL.COM)

Business Tel: 01872 241521; Mobile: Paul Caruana 07866 303405; Graham Hutton 07813 588309

or write to us at: 13, Murdoch Close, Truro, Cornwall TR1 1RR
# Farm survey and biosecurity report form

<table>
<thead>
<tr>
<th>Area checked</th>
<th>Findings</th>
<th>Recommendations &amp; comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrival &amp; departure – disinfectant in use</td>
<td>FAM 30 available and in-use in every area including each paddock. Foot wash bowls covered to avoid dilution from rainwater and loss by evaporation.</td>
<td>None</td>
</tr>
<tr>
<td>Farm boundaries and fencing condition</td>
<td>Double wire fencing and secondary fencing in all main areas to ensure segregation of stock groups. Sheep fencing in many areas. No obvious areas of wildlife ingress over farm boundaries</td>
<td>Sheep fencing is a great indicator of badgers accessing your property, as it is so clear and easy to see when they have. It won’t keep badgers out but it will tell you if they are entering beneath it.</td>
</tr>
<tr>
<td>Wildlife activity found</td>
<td>No badger setts on farm, no badger runs, latrines or muzzling areas found. Signs of lots of rabbits and foxes on the premises.</td>
<td>None concerning badgers. However, foxes do carry sarcoptic mange and can transfer it to other species. Advice should be sought as to the dangers of fox-alpaca interaction and mite cross infection.</td>
</tr>
<tr>
<td>Occupant’s biosecurity awareness</td>
<td>Fully aware of the need for active biosecurity and has implemented all that we already recommend</td>
<td>None</td>
</tr>
<tr>
<td>Housing &amp; shed conditions</td>
<td>Very clean, regularly inspected and well maintained</td>
<td>None</td>
</tr>
<tr>
<td>Water troughs</td>
<td>Excluding the sheep paddock, all troughs were located well above the ground, meeting the minimum recommended height of 30 ins</td>
<td>Ideal height is 48 ins off the ground but is totally impractical to use and implement. Industry recommendation needs to be reviewed</td>
</tr>
<tr>
<td>Ground feeding</td>
<td>No signs of ground feeding or waste feed discarded</td>
<td>None</td>
</tr>
<tr>
<td>Other pests/rodents found</td>
<td>No apparent signs of mice or rat infestation</td>
<td>None</td>
</tr>
<tr>
<td>signage</td>
<td>No obvious signs on display. If there were, we missed them.</td>
<td>Recommend that 'all visitors to report to owner before entering the premises' sign be put on display to ensure unexpected visitors comply with arrival &amp; disinfection procedures.</td>
</tr>
<tr>
<td>TB awareness</td>
<td>Very knowledgeable on all aspects of TB and how it might enter her herd.</td>
<td>None</td>
</tr>
<tr>
<td>Stock faeces removal</td>
<td>Indication that all faeces were being collected and stored in an appropriate area.</td>
<td>None</td>
</tr>
<tr>
<td>Gate condition &amp; effectiveness</td>
<td>All adequate and in good condition</td>
<td>None</td>
</tr>
<tr>
<td>Badger awareness</td>
<td>Not very knowledgeable on tell tale signs to watch out for. With lots of foxes on the property, it would be easy to mistake fox activity with badger.</td>
<td>Information given on the day and photographs &amp; supporting information to be sent via E mail. This will allow easy identification of badger activity as opposed to fox.</td>
</tr>
<tr>
<td><strong>Isolation paddock availability</strong></td>
<td>Excellent isolation paddock available and knowledge of when and how best to use it, especially with confirmed infected animals and their close contacts. Paddock was well gated and practical to use.</td>
<td>None</td>
</tr>
<tr>
<td><strong>General knowledge on animal welfare and species habits</strong></td>
<td>Thorough knowledge on all aspects of alpacas husbandry and obviously very keen on ensuring the best standards and practice are applied at all times.</td>
<td>None</td>
</tr>
<tr>
<td><strong>Mapping availability</strong></td>
<td>Farm boundary maps were not available or used for the survey. At only 5 acres, it didn’t cause a problem. However, they are important to ensure that all areas are surveyed and that we do not trespass on anybody else’s land.</td>
<td>Recommend that every farm has a copy of the farm boundaries available for us to use and return to owner once wildlife activity has been plotted on it.</td>
</tr>
<tr>
<td><strong>Documentation left with owner</strong></td>
<td>A question/answer biosecurity sheet, copy of the Badger Act 1992 and a copy of our TB information sheet was left with the owner</td>
<td>Photos to be sent as agreed with owner</td>
</tr>
</tbody>
</table>

**GENERAL COMMENTS:** This was an excellent visit and one that we enjoyed undertaking. Clearly, great care has been taken to ensure that the possible introduction of infection is minimised and that cross infection is reduced by means of grouping her animals and having isolation paddocks to use in the event of an infection occurring. The practical use of secondary fencing, which wasn’t financially crippling to install, is excellent and should be considered for use by others as a means of installing inexpensive, but effective fencing. Fortunately, there were no obvious signs of badgers entering the premises. Dianne should, though, remain vigilant at all times to ensure that individual, roaming badgers do not access her paddocks. We would recommend a follow up visit in the badger cubbing season(Spring) to determine if badgers have started accessing her land. A boundary walk would suffice in this case, not a full survey.

**Note:** For interest only. The Public Footpath dissecting the farm will always have potential for introducing disease accidentally, and in times of high alert, actions should be taken to eliminate all possibility of public contact with your animals by means of good signage and possible closure of the footpath if the nature of the outbreak demands it.

Farm survey was completed out by: Paul Caruana & Graham Hutton, accompanied by owner  
Date surveyed: 21 December 2009  
Signed: ...........................................................................................................for Field Services South West Ltd(FSSW)
You Have TB in your Herd – WHAT’S NEXT?

Dianne Summers offers help and some practical advice on dealing with TB

As soon as you suffer your first loss to TB, your entire herd is at risk. There are immediate measures you can take to reduce the risk of spread amongst your own herd/neighbouring livestock. Having lost one, there is a strong chance another of this group is infected.

DO NOT WAIT FOR THE CULTURE TO CONFIRM TB WHICH CAN TAKE UP TO 12 WEEKS

ACT IMMEDIATELY

1. Consider the group from which you suffered your first loss as potentially infected.
2. Do not move any of this group out nor move any of your other groups in with this group.
3. Ensure there is no nose-to-nose contact/spitting distance between your other groups/neighbouring livestock. If you cannot move this group to an isolation field you must install perimeter fencing/secondary fencing, including gateways, with at least a 10-foot gap.
4. Foot dips must be used when entering and leaving this field. DEFRA recommends FAM 30 (which kills TB) available from most farming suppliers – not only as a foot dip but for disinfecting stables, equipment, etc.
5. Use separate cleaning equipment for this field – never use it on other fields unless it has been disinfected. If you use a poo hoover, scrub the wheels down before entering other fields. The same applies to any tractors, etc, that have been in this field.
6. Clean water troughs daily. Make sure troughs are a minimum of 3 feet off the ground or in reach of cria.
7. Use as many hay racks a possible to eliminate any fighting/spitting over hay.
8. No hand feeding. You will pass potentially infected saliva from one to the other, let alone yourself.
9. Wear protective clothing and remove it before handling any of your other groups of animals.
10. Wear disposable gloves when handling this group, especially if you are handling the face/mouth area. Remember this is a zoonosis – it can pass to humans, so therefore keep children away and minimise the contact.
11. Try to feed in individual buckets and do not let animals go from bucket to bucket (see photograph). If you cannot do this due to the size of the group, allow plenty of feeding troughs and clean them out after feeding and tip upside down.
12. Monitor your herd daily and often closely. If any of this group or your other groups show any signs/symptoms, REMOVE THEM from this group immediately along with a mate for company, and seek veterinary advice. Do not return this animal to the group until you are certain it does not have TB or it has recovered from the illness. Often they show very subtle signs – get to know your herd. Monitor weight – breathing – feeding habits – lethargy – coughing – stiffness in getting up and kushing down – overall demeanour or any change in their normal behaviour.
13. Notify people if you have sold any of your herd to them or have had matings, etc, with this group as Animal Health/DEFRA may be in contact with them.
14. Animal Health/DEFRA will visit you and ask for all your movement records, so have them ready for your visit. They will discuss the procedures with you. Ask them for a copy of the current policy and procedures and get everything in writing.
15. Also Health Protection Agency (HPA) will contact you to discuss the risks to you and your family/staff and they may arrange X-rays and/or BCG skin tests on those in contact with your herd if they feel it necessary.
16. Your first skin test will be carried out either straightaway or 90 days after your first loss. If TB was evident on post-mortem it is strongly advisable that you request your first skin test is carried out as soon as possible rather than waiting 90 days. It is better to remove reactors as soon as possible. A lot can happen in 90 days.
17. You will need a small pen, approximately 4 feet wide by 5 feet deep or a crush (see photograph). If you make a crush, ensure there is space for the Animal Health vet to get to the armpit. If you can handle your animals, the procedure is not too stressful on your herd and you can simply halter the animal and hold it as you do when you carry out injections. However, if
you can’t then you will need a crush, not only for your own safety but for that of your animals. You can ask your vet to sedate any animal you feel will be too difficult but you will have to pay for that. There are many homeopathy treatments that are very useful, eg, AAA/Valerian for stress – useful not only for your herd but for yourself.

18. You must isolate any reactors as it may take up to 10 days before Animal Health can arrange for removal. Those that fall into the ‘watch’ category must also be isolated. ‘Watch’ is simply those that have had a reaction but not met the current 2 mm measurement for a positive. You will be offered either euthanasia by injection or captive bolt. This will be carried out on-farm.

19. The animal/s will be removed afterwards and taken to the VLA for post mortem, also paid for by DEFRA.

20. If you do not cull your positives, you will not be allowed to undergo any further testing or receive compensation. You will therefore be under restriction until that animal either dies or you cull.

21. Once you have culled your reactor/s or if you suffer any further losses in your herd, the 90-day process begins all over again – so you have a test 90 days after your loss and then another test 90 days after that, providing no further losses have occurred.

22. You may be offered alternative under-trial blood tests. Consider these carefully before agreeing as you will be required to cull ALL positives. Speak to others who have had these tests done. Once again, get everything in writing.

23. If your entire herd tests negative, do not think your herd is in the clear. A negative skin test does not mean your animals do not have TB. Continue to monitor as above.

24. If/when you become clear and restrictions are removed, it is highly recommended that you do not sell/show/move your herd anywhere for a minimum of 6/12 months because of the inaccuracy of the skin test and the risk of infecting other herds. Continue to use all the previous biosecurity measures throughout the quarantine period.

25. Finally – DO NOT go through this on your own. Contact Dianne Summers who not only has first hand experience of TB in her own herd but also heads the Camelid TB Support Group where fellow TB sufferers are in touch with each other and can share advice, symptoms and opinions and someone is always at the end of the phone 24 hours a day 7 days a week. The support is also emotional support, which you will need. Contact Dianne on 01209 822422 or 07949 511316. All data you provide will be treated as strictly private and confidential and will not even be passed on to the other members of the TB support group unless you are happy for this to be done.
Suspected transmission of *Mycobacterium bovis* between alpacas

(letters, the *Veterinary Record* | July 25, 2009, p121–122)

Tuberculosis (TB) caused by *Mycobacterium bovis* is a recognised disease of South American camelids kept in Britain (Barlow and others 1999, Twomey and others 2007). Most cases are associated with spillover of infection from local animal reservoirs, possibly wildlife or cattle, as determined by molecular typing and comparison of isolates recovered from South American camelids and other species (Barlow and others 1999; VLA, unpublished data). To our knowledge, natural transmission of *M. bovis* between South American camelids has not yet been described or documented. We report here the first British case of suspected alpaca-to-alpaca transmission associated with movement of animals to a breeding herd.

Four adult female alpacas from a herd in Devon (A) had visited a breeding herd in south-east England (B) from October to December 2008. The owner noticed clinical signs in two of these, including lethargy, weight loss and occasional coughing, four and eight weeks after returning to herd A, respectively. The disease was progressive and, despite treatment under veterinary supervision, both alpacas eventually died in May 2009.

At postmortem examination, both animals were in poor body condition, weighing 41 and 62 kg. They both showed extensive caseous necrosis of the lungs and thoracic lymph nodes. Additionally, pulmonary cavitation and a few calcified lesions of approximately 1 mm diameter in both kidneys were identified in one alpaca. Acid-fast bacilli were demonstrated on Ziehl-Neelsen staining of fresh tissue smears, and typical granulomatous lesions of TB with acid-fast bacilli were demonstrated by histopathology. *M. bovis* with spoligotype pattern SB0134 (VLA type 35) was subsequently isolated. This was unexpected as *M. bovis* spoligotype SB0274 (VLA type 11) is more commonly isolated from TB cases in this geographic area. Strains with spoligotype pattern SB0134 represent fewer than 0·1 per cent of cattle isolates in this area. Strains with spoligotype SB0134 from herds in different counties strongly suggest alpaca-to-alpaca transmission. Strains with this spoligotype have not been isolated from the vicinity of herd B, which is an area of low TB incidence, and transmission from a local reservoir in south-east England is therefore unlikely. Furthermore, there had been no other animal movements between herd A and other premises to provide an alternative explanation for transfer of strains with this spoligotype.

After searching the VLA TB database for South American camelid submissions, only one other isolate of *M. bovis* spoligotype SB0134 was recorded, also in an alpaca. This animal originated from a herd (C) situated in an area of Shropshire where strains of spoligotype SB0134 are frequently recovered from tuberculous cattle. In February 2009, this alpaca developed weight loss and respiratory disease over three weeks and died despite treatment under veterinary supervision. A postmortem examination was carried out by the attending veterinary surgeon and caseous necrosis suggestive of TB was seen in the lungs. Further testing of affected lung tissue confirmed the diagnosis by demonstrating acid-fast bacilli in Ziehl-Neelsen-stained smears, typical histopathology and positive mycobactericarial culture.

This confirmed case from herd C had not been moved off the premises for at least 16 months. However, another alpaca from herd C had visited herd B in September 2008 and remained there until December 2008 when it developed respiratory disease and died. Although a postmortem examination was not carried out to confirm TB, the clinical signs were consistent with this disease. It is therefore possible that this herd C alpaca transmitted mycobacterial infection to some of the herd A animals temporarily resident in herd B. The pattern of animal movements and isolation of *M. bovis* spoligotype SB0134 from herds in different counties strongly suggests alpaca-to-alpaca transmission. Strains with this spoligotype have not been isolated from the vicinity of herd B, which is an area of low TB incidence, and transmission from a local reservoir in south-east England is therefore unlikely. Furthermore, there had been no other animal movements between herd A and other premises to provide an alternative explanation for transfer of strains with this spoligotype.

In accordance with existing Defra policy, herds A and C are now under movement restrictions pending the outcome of two successive intradermal comparative postaxillary tuberculin tests on all of the remaining animals, carried out at 90-day intervals. The first of these has already been completed for both herds with no reactors identified. Restrictions will be lifted if no reactors are detected at the second herd tests, provided that there is no indication of TB based on clinical or pathological evidence. Following a veterinary risk assessment, herd B was also placed under precautionary movement restriction, but this has now been lifted following tuberculin skin testing of the herd with no reactors identified.

The predominant distribution of tuberculous lesions in the lungs and associated thoracic lymph nodes is similar to most TB cases diagnosed in British South American camelids (Barlow and others 1999, Twomey and others 2007; VLA, unpublished data). Because of this heavy concentration of thoracic mycobacterial infection, the respiratory route is the most likely means of transmission between animals in close contact. This effect may well be enhanced when some of the lesions show pulmonary cavitation. The identification of histologically confirmed mycobacterial granulomas in the kidneys of one alpaca from herd A also raises the possibility of transmission via infected urine.

Movement of South American camelids between premises is reported to be common in Britain (Barnett and others 2008). The biosecurity risk associated with alpaca movements has already been highlighted, with documented cases of bovine viral diarrhoea virus infection and sarcoptic mange occurring as a direct result (Barnett and others 2008, Twomey and others 2009). These new TB cases provide evidence of the risk of spreading *M. bovis* infection through uncontrolled movements of South American camelids between holdings, particularly those situated in recognised endemic TB regions. Herd owners should be encouraged to seek veterinary advice regarding appropriate biosecurity measures when animal
movements are necessary. If private skin testing is being considered, permission to do so must be sought from, and test results reported to, Animal Health.

As previously advised, TB should be considered in South American camelids showing clinical signs of progressive weight loss and respiratory disease (Barlow and others 1999, Twomey and others 2007). The detection of suspect tuberculous lesions during postmortem examination of South American camelids must be notified to Animal Health. The protracted disease course, particularly in herd A, illustrates the potential for further spread. The zoonotic risk to human contacts is also a serious consideration to those handling potentially infected animals.

D. F. Twomey, T. R. Crawshaw, VLA – Starcross, Staplake Mount, Starcross, Exeter EX6 8PE, e-mail: f.twomey@vla.defra.gsi.gov.uk
A. P. Foster, VLA – Shrewsbury, Kendal Road, Harlescott, Shrewsbury SY1 4HD
R. J. Higgins, VLA – Lasswade, Pentlands Science Park, Bush Loan, Penicuik, Midlothian EH26 0PZ
N. H. Smith, VLA – Weybridge, New Haw, Addlestone, Surrey KT15 3NB
L. Wilson, Animal Health, Clyst House, Winslade Park, Clyst St Mary, Exeter EX5 1DY
K. McDean, Animal Health, Sitka House, Shrewsbury Business Park, Shrewsbury SY2 6LG
J. L. Adams, Animal Health, Liberty House, 105 Bell Street, Reigate, Surrey RH2 7JB
R. de la Rua-Domenech, Tuberculosis Programme, Defra, Nobel House, 17 Smith Square, London SW1P 3JR

References
TWOMEY, D. F., BIRCH, E. S. & SCHOCK, A. (2009) Outbreak of sarcoptic mange in alpacas (Vicugna pacos) and control with repeated subcutaneous ivermectin injections. Veterinary Parasitology 159, 186-191
Self-Declaration Form. To be filled in by originating holding

Details of originating Holding

BAS Herd Letters
CPH
Owner’s name
Address
Tel:
Current Parish testing interval

Details of destination Holding/Event

BAS Herd Letters
CPH
Name
Address

Tel:
Current Parish testing interval

I confirm that the alpacas named below/overleaf are in good health and have not been in contact with any livestock with, or on a holding that has, any known health risks (e.g. bTB, BVD, Johnes, coccidia, liver fluke, mange) to the best of my knowledge.

I confirm that we have never refused any official request to skin test for bTB.

I confirm that our holding is not currently under movement restriction.

I confirm that we abide by the BAS Code of Conduct, Biosecurity - Tuberculosis.

I am the owner/agent acting on behalf of the owner named above.

Total number of alpacas moved

Date

Print name

Sign

Animal Name
Tag No
Weight
Date last wormed
Vaccination dates: Clostridial
Bluetongue.
Other treatments within the past 6 months
Any other relevant information

Microchip No
Body score
Product used.

Animal Name
Tag No
Weight
Date last wormed
Vaccination dates: Clostridial
Bluetongue.
Other treatments within the past 6 months
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