VRA3 - What are the risks of causing a new outbreak of foot and mouth disease (FMD) by moving stray susceptible animals from roads within a Restricted Zone?

1. SUMMARY OF OVERALL RISK

This risk assessment was compiled according to terms of reference provided by the Scottish Government regarding time of delivery, title of veterinary risk assessments (VRAs) and level of detail required. EPIC scientists created a generic framework suitable for the VRAs; collated and updated existing information on risks; filled gaps in the documents (including references where appropriate); and drafted new VRAs where necessary. These documents may require updating as new information becomes available or legislation develops, or if more in-depth assessment is necessary.

The purpose of this document is to qualitatively assess the risk of the specified activity in the face of an FMD outbreak in the UK. The assessment includes proposed actions to mitigate the risks associated with the specified activity, and which could form the basis of license conditions, should the activity be permitted. The summary of overall risk below assumes that the risk mitigation measures in Section 8 are implemented.

DEFINITIONS OF RISK LEVEL (OIE 2004, DEFRA 2011):
Negligible *So rare that it does not merit consideration*
Very low *Very rare but cannot be excluded*
Low *Rare but could occur*
Medium *Occurs regularly*
High *Occurs very often*
Very High*: Events occur almost certainly*

Overall risk: The risk of allowing the activity described is **LOW in the Restricted Zone**.

2. LEGISLATION, DEFINITIONS & ASSUMPTIONS

Statutory disease control requirements are applicable to livestock premises on suspicion and confirmation of FMD. When suspicion of disease cannot be ruled out, and diagnostic samples are taken, a Temporary Control Zone is put in place (TCZ) surrounding the suspect premises. On confirmation of disease, a national movement ban (NMB) is enforced by introducing a national Restricted Zone (RZ). A 3 km Protection Zone (PZ) and 10km Surveillance Zone (SZ) are implemented which place restrictions on movements and activities around infected premises to prevent spread of disease. Later in the outbreak, restrictions may be relaxed either through reducing the size of the RZ or through allowing some resumption of normal activities under licence within the RZ, SZ or PZ. In this VRA, RZ is used to refer to areas which are within the RZ, but do not also fall within the PZ or SZ.

An inspector may detain any stray or feral susceptible animal found in a PZ, SZ or RZ and if, having made reasonable inquiries, the inspector cannot ascertain the owner, the inspector may arrange for its destruction (FMD (Scotland) Order 2006 Schedule 4, paragraph 2 and Schedule 6, paragraph 2). In the RZ, movements of animals are permitted, but only under the authority of a licence granted by an inspector (FMD Order (Scotland) 2006, schedule 6, paragraph 1). Although movement of stray animals is not expressly permitted, Paragraph 2 of Schedule 4 implies that they may return to owners. Movement could be licensed under the authority of a declaration by Scottish Ministers as a measure to prevent the spread of disease. (FMD (Scotland) Order 2006, Article 33(2)).

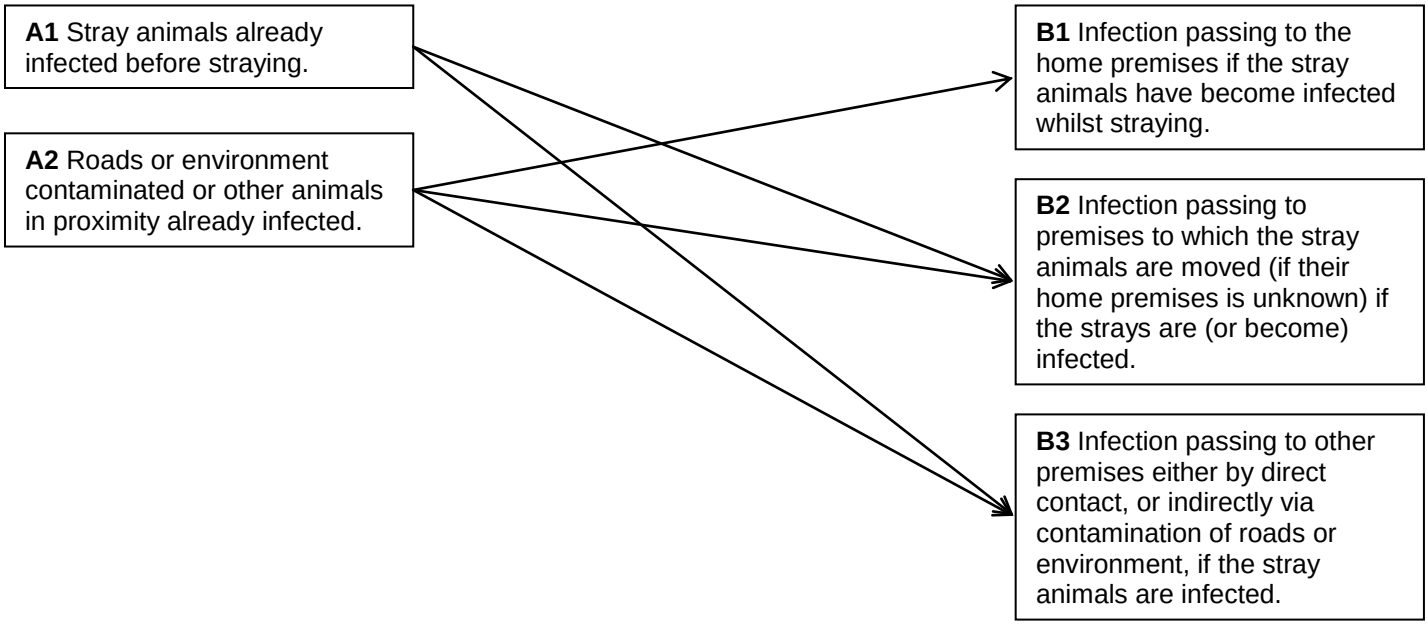
Disinfectants must be approved for use by the Diseases of Animals (Approved Disinfectants) (Scotland) Order 2008 as amended and used at the FMD Order dilution.

3. HAZARD IDENTIFICATION

(a) Hazard: FMD virus (FMDV)

(b) Specific Risk: The movement of stray susceptible domestic animals from a public road risks causing new outbreaks at their destination or home premises, or contamination of the roads, if the animals are infected. However, animals need to be moved for welfare reasons, for reasons of public safety and nuisance and to reduce the risk of their contributing to FMDV transmission if they are or become infected.

4. POTENTIAL RISK PATHWAYS



5. EXPOSURE ASSESSMENT

Factors which are likely to affect this probability of exposure are:	***Comments and risk estimates if/where appropriate***
***Infection source:* A1 Stray animals already infected before straying**	

• Requires animals with undetected or incubating FMD infection, or failure to report FMD	• Animals may incubate FMD for 2 to 14 days before the appearance of clinical signs (Sanson 1994), depending on initial dose, route of infection and virus strain. • Whilst transmission is most likely around the time of or shortly after the appearance of clinical signs (Charleston *et al.* 2011), infected livestock may excrete FMDV for several days before the appearance of clinical signs, potentially leading to transmission or contamination prior to disease detection, particularly in cattle and pigs (Alexanderson *et al.* 2003, Orsel *et al.* 2009). • FMD in sheep can be difficult to detect clinically as not all animals show clinical signs, and clinical signs are usually mild and short lived (Hughes *et al.* 2002).In addition, sheep may be inspected less frequently/thoroughly. There is therefore a higher risk of sheep spreading undetected infection.
Risk that the premises is infected depends on: • Proximity to premises with FMD	• Risk of a premises being infected is highest if it is adjacent or close to premises with FMD. Once a NMB is in place, most transmission occurs by local spread (<3k from premises with FMD) (Gibbens *et al.* 2001, Keeling *et al.* 2001, Haydon *et al.* 2003). • Risk of airborne transmission decreases rapidly with distance from the premises with FMD and is only likely to occur over significant distances if many infected animals (especially pigs) are present (Donaldson and Alexanderson 2001). • Premises with FMD may be already detected ("infected premises"), or as yet undetected. • In a RZ, there are no detected infected premises. There is a risk of as yet undetected premises with FMD but overall the risk of local transmission is very low. • Livestock may stray a considerable distance, potentially between zones, increasing the number of contact premises and roads, and therefore increasing risk. • It may not be possible to establish the origin or ownership of stray livestock. If the premises of origin cannot be established the distance strayed, premises and zones contacted cannot be established. • The likelihood that an unidentified stray in the RZ is infected cannot be assessed.
• Extent and timing of movements of susceptible animals from areas where FMD is present	• Requires movements of infected animals before the NMB, or movements of animals with undisclosed infection by licence. • Likelihood of movements having taken place is influenced by type of premises, for example finishing units are likely to move animals in on a regular basis, where as closed high security units would represent the lowest risk. • In a RZ transmission is most likely to result from movement of animals with undetected infection before the NMB. • Identifying the number and nature of livestock movements from areas where FMD has been detected using livestock movement databases and tracings would allow better quantification of the risk. • Completion of tracings from all infected premises would also give greater certainty.
• Stage of outbreak	• Early in the outbreak there is increased risk of undetected infection and lack of information on movements.

	• Conversely the risk of local spread decreases with time from the last confirmation of disease in a PZ or SZ
• Likelihood of detection and transmission is influenced by FMDV strain	• There are 7 serotypes of FMDV: O, A, C, SAT1, SAT2, SAT3 and Asia 1. The different serotypes (and different strains within each serotype) have different characteristics for example in terms of host species susceptibility, length of incubation period, ease of detecting clinical signs and likelihood of air borne transmission (Kitching and Hughes 2002, Gloster *et al.* 2008). Much UK research is based on the 2001 outbreak, which was caused by serotype O, strain PanAsia. However future outbreaks may involve other serotypes/strains and therefore present different epidemiological situations. On confirmation of FMDV, the serotype and strain would be identified by The Pirbright Institute. This information would help to inform estimates of risk.
Infection source: **A2 Roads or environment contaminated or other animals in proximity already infected**	
• Proximity to premises with FMD	• Risk of infecting livestock is highest where a road is adjacent or close to premises with FMD. Once movement bans are in place, most transmission occurs by local spread as described above. It is difficult to quantify relative risks associated with different transmission routes within local spread but indirect transmission via fomites and contamination around a premises with FMD are likely to play an important role. • The risk of local transmission within a RZ is low, as above.
• Extent and timing of movements of susceptible animals from areas where FMD is present	• Roads could be contaminated with FMDV if there have been movements of infected animals before the NMB, or movements of animals with undisclosed infection by licence. • Movements of animals from the PZ/SZ or from markets before the NMB represent the highest risk.
• Biosecurity of local premises, cleansing and disinfection procedures in place	• FMDV is very sensitive to approved disinfectants and good biosecurity will reduce risk of virus transfer to roads via fomites such as personnel, vehicles and equipment.
• Presence of susceptible wildlife species	• All British deer species are susceptible to infection and can transmit virus to domestic livestock experimentally (Gibbs *et al.* 1975).Wild boar are also susceptible (Elbers *et al.* 2003, Hartley 2010) but the density of wild boar in UK is very low. However, in Western Europe post-outbreak serosurveys and diagnostic testing of animals with suspicious clinical signs have never revealed deer or wild boar carrying FMDV antibodies or FMDV (Elbers *et al.* 2003, Mouchantat *et al.* 2005) and there is no evidence to suggest that deer or boar have played a role in FMDV spread in UK. Other wildlife species can carry FMDV mechanically but this is very unlikely to be important except close to premises with FMD. Overall the risks of wildlife causing contamination of roads or the environment in the RZ are negligible.
• Survival of FMDV on road	• FMDV can survive on average for 2 to 3 months in bovine faeces at 4^{o}C. Survival duration increases with decreasing temperatures and presence of organic material and varies with virus strain (reviewed by Bartley *et al.* 2002).
Risk of transmission: **B1 Infection passing to the home premises if the stray animals have become infected whilst straying**	

• Risk of strays picking up infection from environment depends on the distance and duration of straying and density and proximity of susceptible livestock nearby	• Animals which have covered larger distances or strayed in areas of high livestock density have more potential for exposure to infected animals or contamination.
• Failure to detect FMD in the stray animals before movement	• Examination of the animals for clinical signs of FMD will reduce the risk, but unless animals have strayed for several days they are likely to be in the incubation stage of disease with no clinical signs.
• Number and species of other susceptible animals on the home premises and ability to keep stray animals separate from other susceptible livestock	• Whilst these factors do not affect the risk of the home premises becoming infected, smaller numbers of animals or effective separation of animals may reduce the risk of onward transmission to other premises by decreasing the total number of animals that become infected at the premises and hence total viral load. Statutory movement standstills will reduce risk of onward transmission to other premises through further animal movements.
Risk of transmission: **B2 Infection passing to premises to which the stray animals are moved (if their home premises is unknown) if the strays are (or become) infected**	
• Failure to identify the owner of the stray animal	• More likely with sheep • The distance strayed and contact premises are unable to be assessed. The likelihood of contact with premises or livestock with FMD depends on the distance of the stray from the SZ and PZ.
• Number and species of stray animals	• Larger groups increase the risk of transmission if infection is present. Species vary in their virus production; pigs are higher risk than dairy cattle, which are higher risk than sheep.
• Failure to detect FMD in the stray animals before movement	• Examination of the animals for clinical signs of FMD will reduce the risk, but unless animals have strayed for several days they are likely to be in the incubation stage of disease with no clinical signs.
• Number and species of other susceptible animals on the premises to which stray animals moved and ability to keep stray animals separate from other susceptible livestock	• Whilst these factors do not affect the risk of the premises becoming infected, smaller numbers of animals or effective separation of animals may reduce the risk of onward transmission to other premises by decreasing the total number of animals that become infected at the premises and hence total viral load. Movement standstills will reduce risk of onward transmission to other premises through further animal movements.
Risk of transmission: **B3 Infection passing to other premises either by direct contact, or indirectly via contamination of roads or environment, if the stray animals are infected**	
• Number and species of stray animals	• Larger groups increase the risk of transmission if infection is present. Species vary in their virus production; pigs are a greater risk than dairy cattle, which are a greater risk than sheep.
• Distance travelled along public road	• Increasing distance increases risk of contamination, and makes cleansing increasingly difficult.
• Traffic volume	• Busy roads will increase the risk as if virus is present it will be disseminated further.
• Density of livestock on other premises and proximity to the road	• The location of livestock within premises is likely to vary seasonally. If animals are grazed or housed close to the road there is a higher risk of direct or indirect transmission.
• Cleaning public road after strays moved	• Whilst this reduces risk, it is likely to become increasingly difficult if large distances have been covered.
• Length and duration of journey and number of stops en route whilst moving strays	• Longer journeys or multiple stops increase risk but should not be necessary for movement of stray animals.
• Suitability of vehicle used to move the strays, and cleansing and disinfection of vehicle, personnel and	• FMDV is very sensitive to suitable disinfectants and good biosecurity will reduce risk of virus transfer to roads via

equipment before and after use	fomites such as personnel, vehicles and equipment.
• Proximity of journey route to susceptible livestock	• High density of susceptible livestock will increase risks.

6. CONSEQUENCE ASSESSMENT

Spread of FMD to uninfected premises.

7. RISK MANAGEMENT OPTIONS

The movement of stray susceptible animals from a road within a Restricted Zone carries a risk that FMD will spread to previously uninfected premises, either the home premises of the stray animals, alternative premises they are moved to or other premises in the vicinity. The greatest risks are associated with the presence of undetected infection and the possibility that stray animals could contaminate large areas with FMDV by moving long distances. These movements may need to take place early in an outbreak, before full information is available regarding movement history and before a full incubation period has passed, meaning that undisclosed infection may be present.

Options are:

(i) Do not permit stray animals to move either to their home premises or to alternative premises. These animals would then have to be humanely destroyed.

(ii) Allow animals to move to home premises if identified but under certain conditions, in particular ensuring no other movements from the premises for at least one incubation period. If the owner cannot be identified the animals have to be humanely destroyed.

(iii) Allow animals to move to home premises as above. If the owner cannot be identified move animal to alternative premises under certain conditions regarding cleansing, disinfection and movements.

Option (i) represents the lowest risk of disease transmission but may be difficult to achieve safely and without causing public alarm or distress. It is unlikely that this degree of risk mitigation would be necessary in the RZ. In the RZ, options (ii) or (iii) are appropriate. The decision as to whether animals should be moved to alternative premises may depend on the availability and suitability of such premises.

Overall the risk is low in the RZ, provided mitigation measures are observed.

This risk level was assigned based on scientific literature available and expert opinion where appropriate by considering the risk pathways and the factors affecting each risk pathway, as listed in sections 4 and 5.

8. SUGGESTED RISK MITIGATION MEASURES

Subject to the following safeguards, in a RZ movement of stray animals to their home premises or to pre-approved premises represents a low risk, provided the following risk mitigation strategies are in place:

A. When the animals are first discovered

(i) Check for any form of identification – ear tag, ear tattoo, EID.

(ii) If owner can be confirmed assess how far and where the animals are likely to have strayed.

B. If the owner of the strays is known

(i) If the animals are judged to have strayed from the PZ or SZ they should not be permitted to be moved and should be humanely destroyed. The AHVLA field service office and local authority should be notified.

(ii) If the owner of the stray animals is known or can be quickly identified, then the owner should immediately come and take the stray animals back home.

(iii) Vehicle, personnel and equipment used to move the animals must be subject to appropriate cleansing and disinfection before leaving their home premises and immediately after moving the animals. Approved disinfectants must be used at the correct concentration.

C. If the owner of the strays is not known

If the owner of the stray animals is not known or cannot be quickly identified, then the following authorities may be contacted to move the animals:

- Police
- Local council
- Highway authority
- Scottish SPCA

If an inspector cannot ascertain the owner of a stray in the RZ the inspector may arrange destruction without the need for a licence.

The move must be subject to several controls:

i) Whichever authority moves the animals must inform the local Animal Health Division Office (AHDO) and the local council of the nature and destination of the move, including details of the owner if known.

ii) The animals must be moved to pre-approved premises as arranged by the authority moving the animals e.g. Scottish SPCA animal welfare centre.

iii) Vehicle, personnel and equipment used to move the animals must be subject to appropriate cleansing and disinfection before leaving their home premises and immediately after moving the animals. Approved disinfectants must be used at the correct concentration.

Iv) Carcases should be uplifted in accordance with licence conditions for uplift of fallen stock.

D. ***General movement rules***

i) Stray animals must be inspected for any clinical signs of FMD before movement. Any animal humanely slaughtered should be inspected before collection for disposal.

ii) The road on which the stray animals were present should be thoroughly brushed/scraped immediately after the animals have been moved. The owner of the animal (if identified) is responsible for ensuring that there is no presence of any faeces etc. which may contain FMDV and could contaminate passing vehicles. Any waste which requires disposal should be taken back to the owner's premises and disposed of by the livestock owner in line with their appropriate normal disposal methods or uplifted for disposal where the owner is unknown.

iii) No animals should move off the premises to which the stray is moved for 21 days.

iv) A detailed record of the move and the stray animal information must be kept (statutory legislation covers movement records).

v) The move must be undertaken as quickly as possible.

vi) The move must be undertaken by the most direct route with no stopping points en route.

It is assumed that all relevant legislation normally applicable is followed, for example regarding livestock identification and recording of movements.

9. SOURCES OF EXPERT ADVICE

This VRA is based on VRA 2009 #2 "What is the risk of causing new outbreaks of FMD by moving stray susceptible animals from roads within a restricted zone?"

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11. REFERENCES

Alexanderson S, Zhang Z, Donaldson AI, Garland AJM (2003) The pathogeneses and diagnosis of foot-and-mouth disease. *Journal of Comparative Pathology* 129, 1-36.

Bartley LM, Donelly CA, Anderson RM (2002) Review of foot-and-mouth disease virus survival in animal excretions and on fomites. *Veterinary Record* 151, 22, pp667-669.

Charleston B, Bankowski BM, Gubbins S, Chase-Topping ME, Schley D, Howey R, Barnett PV, Gibson D, Juleff ND, Woolhouse MEJ (2011) Relationship Between Clinical Signs and Transmission of an Infectious Disease and the Implications for Control. *Science* 332, 6030, pp726-729.

Defra, (2011) Qualitative analysis of the risk of introduction of Equine Infectious Anaemia (EIA) into Great Britain from an EIA endemic area through temporary movement of UK origin horses (Roberts, H. & Paterson, A.) Veterinary Science Team, 17 Smith Square, London, SW1P 3JR, United Kingdom. Version 1.0, Released 20 June 2011, p15.

Donaldson AI, Alexanderson S (2001) Relative resistance of pigs to infection by natural aerosols of FMD virus. *Veterinary Record* 148, 19, pp600-602.

Elbers ARW, Dekker A, Dekkers LJM (2003) Serosurveillance of wild deer and wild boar after the epidemic of foot-and-mouth disease in the Netherlands in 2001. *Veterinary Record* 153, 22, pp678-681.

Gibbens JC, Sharpe CE, Wilesmith JW, Mansley LM, Michalopoulou E, Ryan JBM, Hudson M (2001) Descriptive epidemiology of the 2001 foot-and-mouth disease epidemic in Great Britain: the first five months. *Veterinary Record* 149, 24, pp729-743.

Gibbs EPJ, Herniman KAJ, Lawman LJP, Sellers RF (1975) Foot-and-mouth disease in British deer – transmission of virus to cattle, sheep and deer. *Veterinary Record* 96, 26, pp558-563.

Gloster J, Doel C, Gubbins S, Paton DJ (2008) Foot-and-mouth disease: Measurements of aerosol emission from pigs as a function of virus strain and initial dose. *Veterinary Journal* 177, 3, pp374-380.

Hartley M (2010) Qualitative risk assessment of the role of the feral wild boar (*Sus scrofa*) in the likelihood of incursion and the impacts on effective disease control of selected exotic diseases in England. *European Journal of Wildlife Research* 56, pp401-410.

Haydon DT, Chase-Topping ME, Shaw DJ, Matthews L, Friar JK, Wilesmith J, Woolhouse MEJ (2003) The construction and analysis of epidemic trees with reference to the 2001 UK foot-and-mouth outbreak. *Proceedings of the Royal Society of London Series B-Biological Sciences* 270, pp121-127.

Hughes GJ, Mioulet V, Kitching RP, Woolhouse MEJ, Alexanderson S, Donaldson AI (2002) Foot-and-mouth disease virus infection of sheep: implications for diagnosis and control. *Veterinary Record* 150, 23, pp724-727.

Keeling MJ, Woolhouse MEJ, Shaw DJ, Matthews L, Chase-Topping M, Haydon D, Cornell SJ, Kappey J, Wilesmith J, Grenfell BT (2001) Dynamics of the 2001 UK foot and mouth epidemic: Stochastic dispersal in a heterogeneous landscape. *Science* 294, 5543, pp813-817.

Kitching RP, Hughes GJ (2002) Clinical variation in foot and mouth disease: sheep and goats. *Revue Scientifique et Technique de l'Office International des Epizooties* 21, 3 pp505-512.

Mouchantat S, Haas B, Lutz W, Pohlmeyer K, Frolich K (2005) Absence of antibodies to foot-and-mouth disease virus in free-ranging roe deer from selected areas of Germany (2001-2002). *Journal of Wildlife Diseases* 41, 3, pp599-605.

OIE (2004) Handbook on Import Risk Analysis for Animals and Animal Products: Introduction and qualitative risk analysis, Vol.I. OIE Publications, Paris.

Orsel K, Bouma A, Dekker A, Stegeman JA, de Jong MCM (2009) Foot and mouth disease virus transmission during the incubation period of the disease in piglets, lambs, calves, and dairy cows. *Preventive Veterinary Medicine* 88 2, pp158-163.

Sanson RL (1994) The epidemiology of foot-and-mouth disease: Implications for New Zealand, *New Zealand Veterinary Journal* 42, 2 pp41-53.

12. NOTES

None