

INTERNATIONAL ANIMAL HEALTH DIVISION

International Disease Monitoring Unit

Qualitative Risk Assessments

www.defra.gov.uk/animalh/diseases/monitoring/index.htm



Ref: VITT1200/EIA

Version No.:	1
Date:	14 September 2006

EQUINE INFECTIOUS ANAEMIA:

POTENTIAL RISK FACTORS FOR THE INTRODUCTION OF THE VIRUS TO GREAT BRITAIN FROM EU MEMBER STATES AND COUNTRIES NEIGHBOURING THE EU

Dr Mirzet Sabirovic
Dr John Matthews
Kulin Patel
Andrew Kingston
Mauricio López
Graeme Cooke
Dr Nick Coulson
Fred Landeg

DISCLAIMER: IAHD reserves the right to update this publication and make changes to the outcomes at any time if new information become available following this release. The update will be carried out without prior notice. This publication or any related updates are published at the Defra's website above. This publication and any subsequent update, if available, may be used free of charge in any format or medium provided it is used accurately and not used in a misleading context. The material must be acknowledged as crown copyright and the title of the publication specified.

Suggested reference for this publication:

Defra, (2006). Equine Infectious Anaemia: Potential risk factors for the introduction of the virus to Great Britain from EU Member States and countries neighbouring the EU. (Authors: Sabirovic, M., Matthews, J., Patel, K., Kingston, A., López, M., Cooke, G., Coulson, N., Landeg, F.), International Animal Health Division, 1A Page Street, London, SW1P 4PQ, United Kingdom. Version 1, Released 06 July 2006, p. 26.

©Crown copyright

Copyright in the typographical arrangement and design rests with the Crown

Table of Contents

1	Summary.....	3
2	Introduction	4
3	Hazard identification	5
4	Risk assessment.....	6
4.1	Release Assessment.....	6
4.1.1	Terms and definitions	6
4.1.2	Intra-Community trade - Conceptual pathways.....	7
4.1.2.1	Legal movements.....	7
4.1.2.1.1	Live horses	7
4.1.2.1.2	Germplasm	10
4.1.2.1.3	Use of authorised biologicals not known to be contaminated	11
4.1.2.2	Illegal movements	11
4.1.2.2.1	Use of contaminated unauthorised biologicals	11
4.1.2.2.2	Illegal movements of horses	11
4.1.3	The disease.....	11
4.1.3.1	The virus	11
4.1.3.2	The host	12
4.1.3.3	The environment.....	13
5	Conclusions.....	14
6	References.....	16

1 Summary

Equine infectious anaemia (EIA) is a disease that affects equidae (such as horses, mules, donkeys) only. EIA is considered to be present in Russia, the Balkan countries, Romania and Turkey. As a result, there is an increased likelihood of the introduction of the disease to the EU Member States neighbouring the affected countries, particularly through illegal movement of horses. This emphasises the importance of maintaining appropriate border control measures in the EU Member States that share borders with these European countries.

Historical data shows that sporadic cases of EIA have been detected in several EU Member States. However, most of these cases appear to have involved a limited number of infected horses and rarely resulted in lateral transmission to susceptible horses. All these episodes appear to have been effectively controlled at the time and did not result in a major epizootic in the affected EU Member State.

The EIA status of most of the horse population in the EU remains largely unknown as surveillance is not carried out. Usually only a relatively few horses (mainly racing horses) are closely monitored and possibly tested for EIA.

It is likely that EIA may be present at a low level in the population of horses that are not usually closely monitored or tested. It is unknown to what extent horses with inapparent infection (i.e. showing no clinical signs) may be examined, assessed as clinically healthy and then move between Member States. Such horses may become a source of infection to other susceptible horses under optimal conditions. Therefore, the likelihood of introducing the virus into the horse population in the UK remains uncertain.

The health statement for EU intra-Community movement requires all horses to be clinically examined and declared healthy prior to movement. Movement of live horses within the EU does not require horses to be tested for EIA, but they must come from a holding free from EIA. That is, once the infection has been detected at premises, EU rules do not allow movement of horses from such premises until certain conditions are fulfilled to show that freedom from the disease has been achieved.

The requirement for health certificates and clinical examinations prior to movement does not apply to the movement of registered horses under the Tripartite Agreement (TPA) between the UK, Republic of Ireland and France. These horses are usually closely monitored and tested on occasion for EIA. Therefore, the introduction of the virus to the UK by registered horses showing clinical signs is highly unlikely. However, there is a low likelihood that some clinically normal horses with inapparent infection may introduce the virus to the

UK through movement from other Member States. As above, this also has a low chance of occurring and would need optimal conditions for transmission of the virus. This highlights the importance of the industry applying appropriate management practices and biosecurity in order to mitigate any possible exposure of registered horses to other horses with unchecked health status.

There is a low likelihood of virus being legally introduced to the UK by the use of contaminated biologicals. The use of such contaminated substances over a wide area would provide a multifocal means of introduction. Semen collected during the viraemic phase of the disease can also occasionally transmit the virus.

It is likely that the introduction of the virus to the UK could result in a local spread under optimal conditions (i.e. mixing with other horses or mechanical transmission by an abundance of the required biting flies). However, to what extent this local spread could result in the further distribution of the virus within the UK would greatly depend on the movements of the infected horse and those in-contact horses that have become infected. Biting flies, e.g. stable and horse flies as well as biting midges, are widely distributed and most active and abundant in the summer months. However, it is known that the virus is only associated with interrupted feeding of such flies, which are thought to have relatively short flying times, thereby limiting the range of mechanical transmission. On the other hand, use of contaminated hypodermic needles and surgical equipment could also result in a local spread of the virus.

2 Introduction

This qualitative risk assessment considers the likelihood of the introduction of equine infectious anaemia virus (EIAV) to the UK through intra-Community trade.

It builds on a previous preliminary outbreak assessment that has been carried out by Defra (<http://www.defra.gov.uk/animalh/diseases/monitoring/poa.htm>) following confirmed cases of equine infectious anaemia (EIA) in the Republic of Ireland.

Unless otherwise stated, this document uses official information received from the World Organisation for Animal Health, Paris, France (http://www.oie.int/eng/info/hebdo/A_INFO.HTM) and the European Commission, Brussels, Belgium (Animal Disease Notification System, Weekly Reports, CVO Emergency Notifications, SANCO Documents). It covers the period from October 2005 until early June 2006. Maps were produced using ESRI Data and maps CD - 2002.

The Republic of Ireland (RoI) reported two cases of EIA on two stud farms in north-eastern part of the country in mid June 2006. The authorities suspect that the introduction of new animals or animal products may have been implicated in these cases (OIE, 2006). The Republic of Ireland has never reported a case of EIA before this incident. By the end of July 2006, RoI had further informed UK that subsequent investigations had confirmed more cases in already-identified high-risk contact horses.

Northern Ireland reported an outbreak in Londonderry that started in late August 2006 and was first confirmed at the beginning of September 2006. The outbreak resulted from the legal movement of an animal that had attended a veterinary hospital in RoI for three weeks in June and July.

This risk assessment principally addresses the assessment of the likelihood of the introduction of EIA virus to the UK through intra-Community trade in equidae. As a working hypothesis, several risk pathways through which the virus could be introduced are considered.

4 Risk assessment

4.1 Release Assessment

4.1.1 Terms and definitions

For the purpose of the release assessment (Section 4.1) the following definitions will apply:

Term	Definition
Equidae	<i>Horses, mules and donkeys</i>

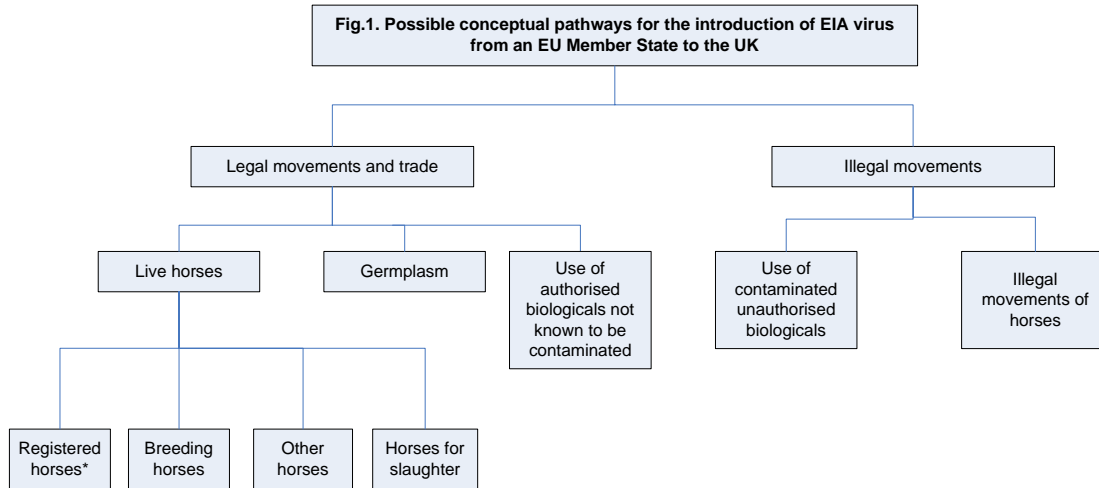
For the purpose of the release assessment (Section 4.1) the following terminology* will apply (OIE, 2004):

Term	Definition
Likelihood	Probability; the state or fact of being likely
Likely	Probable; such as well might happen or be true; to be reasonably expected
High	Extending above the normal or average level
Highly	In a higher degree
Low	Less than average; coming below the normal level
Negligible	Not worth considering; insignificant
Remote	Slight, faint

* This risk assessment uses the OIE recommended terminology. This is important to maintain consistency in expressing estimates. Defra is aware of some concerns that have been expressed lately about the appropriateness of this terminology for practical purposes (i.e. clarity for the purpose of understanding by wider non-technical audience). Defra will consider this issue in the future.

4.1.2 Intra-Community trade - Conceptual pathways

This risk assessment recognises that there are broadly two major streams of pathways (routes) by which the EIAV can be introduced from an affected EU Member State to the UK (Fig. 1).



* Registered horses in accordance with Directive 90/427 are equidae which are entered or registered and eligible for entry in a studbook in accordance with the rules laid down pursuant to Article 4(2)(b) and identified by means of the identification document provided for in article 8(1).

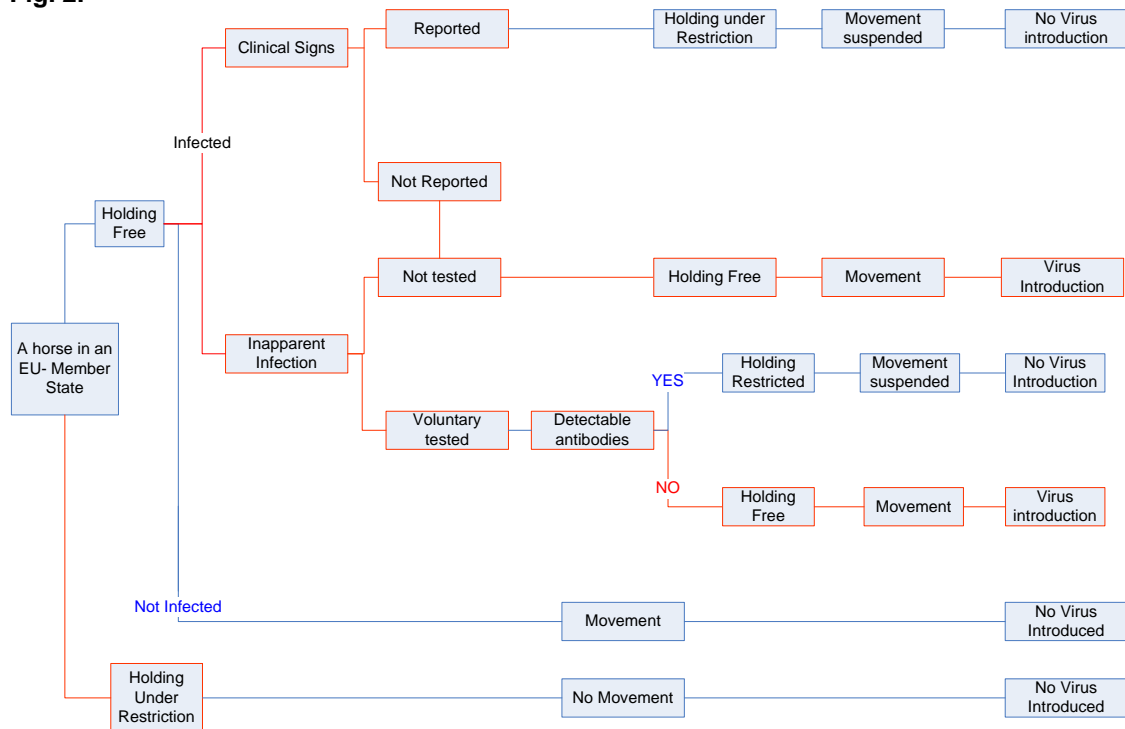
4.1.2.1 Legal movements

4.1.2.1.1 Live horses

The scenario tree (Fig.2) outlines possible routes by which the virus may be introduced from an EU Member State to the UK.

The movement of equidae within Member States of the European Union is subject to harmonized rules. These rules do not require any testing of equidae for EIA before movement from one EU Member State to another. The rules require equidae to be accompanied by a passport and a health document stating that the equidae come from a holding free of restrictions due to notifiable diseases of equidae and are clinically healthy at the time of examination. EIA is a disease officially notifiable in the EU. Under EU rules, a period of prohibition must be imposed to prevent movement of susceptible equidae from affected premises.

Fig. 2.

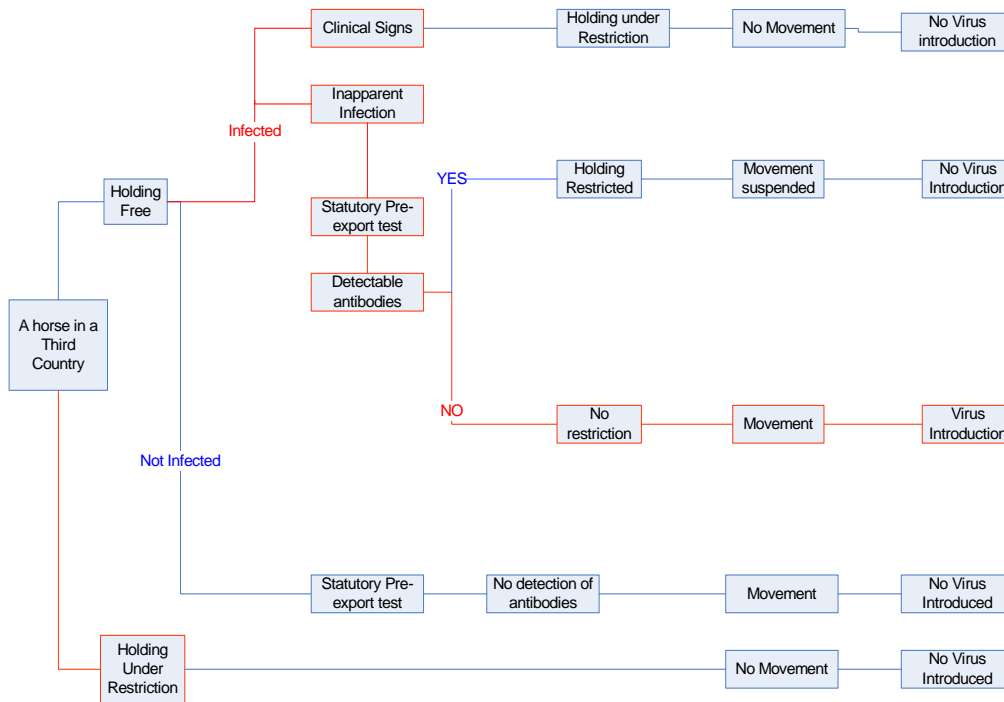


Infected equidae have to be slaughtered, then all remaining equidae must be subjected to two negative tests for EIA three months apart before being allowed to move from the premises.

Horses from Third Countries (any country outside the EU) must meet the same holding freedom requirements as those moved between Member States and with one exception (re-entry of registered horses after temporary export from the EU), require a negative EIA test prior to importation (Fig. 3).

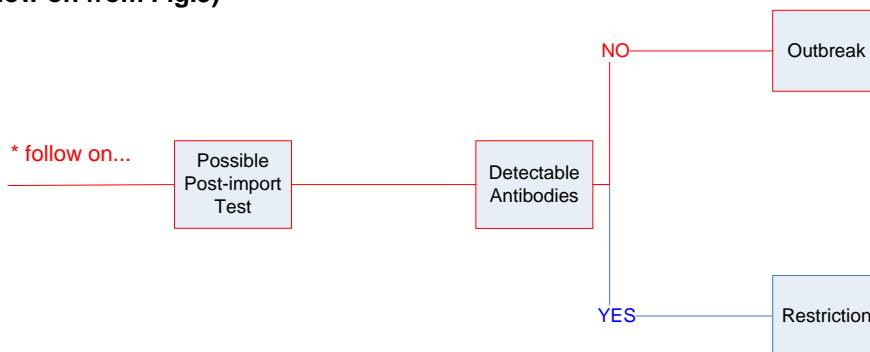
Currently, the UK does not require random post-import check testing of horses from the former 15 EU Member States. However, as provided by EU rules, the UK does require that a proportion of horses arriving from the 10 EU Member States which joined in May 2004 be tested. Testing of approximately 5,800 UK resident horses for export purposes in the period from 2004 to 2006 produced no positive results.

Fig. 3.



Approximately 3900 non-UK resident horses entering the UK have also been tested with negative result during the same period. (Wibberley, G., VLA, Weybridge, UK - personal communication to J. Matthews, August 2006). Equidae imported from Third Countries are also subject to random post-import checks (Fig. 4).

Fig.4. (follow on from Fig.3)



We do not have reliable information on the number of horses that are tested for EIA in the EU to estimate the prevalence of the disease in each EU Member State. However, the number of confirmed outbreaks is reported on the EU animal

diseases notification system (ADNS) (more than 16 in 2006, 15 in 2005, 3 in 2004). We also do not have records of all horses that move between the EU Member State as movements of registered horses between Member States do not have to be recorded on the EU electronic notification system (TRACES).

The Tripartite Agreement (TPA) between UK, Ireland and France is a longstanding agreement pre-dating the introduction of harmonised EU rules for the movement of equidae. This agreement was updated in May 2005. EU rules allow Member States to grant one another derogations from the inspection and certification requirements imposed on horses moving between EU countries, provided that equivalent animal health guarantees are implemented. Under the TPA, UK, France and Ireland notify each other of confirmed cases of listed diseases, including EIA, and of any significant developments and apply animal health restrictions to ensure that following confirmation of disease, all horses moved between the participating countries meet EU requirements. Horses moved between the participant countries must have passports, but do not need to be accompanied by health certificates (unless exported for slaughter).

4.1.2.1.2 Germplasm

EU rules for intra-Community trade in ova and embryos of the equine species are harmonised and subject to health certification. These rules require that at the time of collection of the ova or embryos, donor mares are not on premises that are subject to restrictions due to EIA as required under the rules for trade in live equidae and that donor mares are free from infectious and contagious diseases. The rules for intra-Community trade do not require testing of donor mares for EIA, but for imports from third countries, donors must be tested for EIA prior to collection.

EU rules for intra-Community trade in semen of the equine species or semen for the production of embryos for intra-Community trade are harmonised and subject to a health certificate. These rules require that donor stallions entering an approved semen collection centre meet the requirements for the movement of equidae between Member States, including the requirements for holding freedom from EIA. The rules also require that donor stallions are free from infectious and contagious diseases at the time of semen collection and are tested negative for EIA. Semen imported from approved third countries must be collected from stallions that have been subjected to the testing protocol for EIA specified in the harmonised animal health certificate.

4.1.2.1.3 Use of authorised biologicals not known to be contaminated

Epizootics of EIA due to the use of sera or vaccines produced from inapparently infected horses have been recorded in the past (Cvetnic, 1983). The disease has also been considered to be present on certain horse urine production farms in Alberta (Darcel, 1996).

4.1.2.2 Illegal movements

4.1.2.2.1 Use of contaminated unauthorised biologicals

The import and use of substances to be administered to horses is subject to EU rules. Nevertheless, the possibility of illegal use of unauthorised substances cannot be ruled out. This can probably be ruled out in the case of EIA in the RoI (RoI, personal communication, September, 2006).

EIA virus may incidentally be injected by contaminated surgical instruments or hypodermic needles (Umphenour, 1974).

4.1.2.2.2 Illegal movements of horses

Random checks at the UK border periodically reveal documentary deficiencies. However, significant non-compliance with the EU movement rules appears to be a rare event.

4.1.3 The disease

In the context of the potential exposure of horses to infection in an EU Member State, the following has been considered:

4.1.3.1 The virus

EIAV is a Lentivirus that belongs to the family *Retroviridae*. Other animal lentiviruses include maedi-visna (sheep and goats), ovine progressive pneumonia (sheep) and bovine and feline lentiviruses (Dawson, 1988).

4.1.3.2 The host

EIAV infects equidae only, which then remain infected for life. There is no evidence that other animals are susceptible to infection with EIAV. There is no risk to public health.

Horses naturally infected with EIAV develop a persistent infection. It is estimated that more than 30% (Issel and others, 1985) to more than 90% of these horses remain clinically healthy and show no signs of the disease (Issel and others, 1982, Issel and others, 1988). Persistent infection results from the ability of the virus to circumvent or overcome the host immune responses (Payne and others, 1987).

Persistently infected horses are considered to have a lower level of the virus in their blood than during viraemia. Some persistently infected horses may develop the acute form of the disease (Issel and others, 1982) and, in this event, most are likely to die. In the acute form of the disease, horses frequently have very high levels of the virus during viraemia (Issel and others, 1988).

Horses with the acute form of the disease are considered to be the most likely donors of the virus for mechanical transmission by biting flies (Issel and others, 1988). Infected horses need to carry at least 10^6 infective doses of the virus per ml of their blood in order for biting flies to successfully infect other horses (Issel and others, 1990). Persistently infected horses only have $1/250^{\text{th}}$ of this dose level, but horses in the acute phase of the disease may exceed the required infective dose level (Issel and others, 1990).

While most horses with the acute form of the disease are likely to die, some may survive. The available literature does not provide any data on the proportion of horses that survive. The survivors may also develop a chronic form of the disease with periodic febrile episodes or remain as inapparent carriers (Issel and others, 1982) with persistent pyrexia. In either cases, such horses remain carriers of the virus for life.

The presence of infection has been detected in about 0,3% to 3,3% of horses tested in four States in the USA in the early 1980s (Hall and others, 1988).

A retrospective study of EIA based on the Canadian Control programme showed that the mean age of infected horses varied between 7 and 8.5 years. However, positive reactors have been detected among horses of all ages. The rate of infection in female horses compared to male horses was approximately 2:1. The infection rate in geldings compared to stallions was approximately 2:1. No significant differences were noticed from year to year, although in the later years of the study reactors tended to be slightly older (Paquette, 1985).

One study showed that most of the infected horses will develop antibodies that can be detected by the Coggin's test (agar-gel immunodiffusion test – AGID) on average up to 24 days after infection. However, in these experiments it took 45 days for one of the naturally infected horses to develop detectable antibodies using AGID test (Issel and others, 1982). It is also considered that it might take longer (up to 3 months or more) before antibodies can be detected in at least a few infected horses (Steinbach, F., VLA, Weybridge, UK – personal communication to M. Sabirovic, August 2006)

Using the AGID test, one study found that detectable immunity to EIA virus in colostrum was present for 25 to 195 days, with a mean of 124 days. While colostral immunity may protect against infection with a homologous strain for a period, it is unlikely that this protection will be effective against infection with a heterologous strain of the virus (Issel and others, 1985). This is not surprising given that the EIA virus is known to be prone to antigenic drift (Cvetnic, 1983).

4.1.3.3 The environment

Foil and others (1983) consider that biting insects, such as deer flies, horse flies and stable flies rather than mosquitoes, play the primary role in mechanical transmission of the EIA virus. Horse flies are persistent feeders. Their bite is painful because of cutting/slashing action of their mouthparts (Issel and Foil, 1984), thus, their feeding is often interrupted by the reaction of a horse (Kemen and others, 1978)

Experimental studies (Issel and others, 1982) demonstrated that horses in the acute phase of the disease and already febrile are most likely to serve as a source of the virus for transmission to other susceptible horses. The virus may also be transmitted at a low rate from inapparently infected horses to susceptible horses (Issel and Coggins, 1979), however, this is unlikely to result in the generation of epizootics of the disease unless conditions are optimal (Issel and others, 1982).

Under optimal conditions, such as when infected horses, particularly those in acute phase of the disease, are mixed with susceptible horses during seasons when biting insects are abundant, will create the potential for EIAV transmission (Foil and others (1983). Therefore, infected horses may introduce the virus into a naïve population resulting in generation or selection of the virus strain that is more virulent (Issel and others, 1982). However, mechanical transmission in natural conditions is considered to be random. This level of randomness is increased with higher population levels of the biting insects (Issel and Foil, 1984).

One study demonstrated that the efficiency rate in mechanical transmission by groups of horseflies that have been isolated for 3, 10 and 30 minutes after

feeding on infected horses before re-feeding on susceptible horses was around 15% (1 successful transmission in 7 trials) (Hawkins and others, 1976). In another experimental study the transmission rate by deer flies and stable flies that were immediately transferred to susceptible horses was much higher (approx. 75%) (Foil and others, 1983). The home range of horseflies has been estimated to be around 4 miles. Some authors consider that the segregation of infected horses at the distance of at least 200 yards from susceptible horses may not be an adequate safeguard measure, particularly in areas where these flies are abundant (Hawkins and others, 1976). Issel and Foil (1984) extrapolated that approximately 99% of horse flies would be expected to return to their original host to feed again after interruption of feeding if they were released when alternative hosts were at a distance of up to 160 feet. Therefore, a 200 yard distance between infected and susceptible horses is considered to adequately reduce the potential for transmission of EIA virus by horseflies.

The likelihood that a susceptible horse will become infected with the EIAV depends on the proximity to a donor horse, the quantity of the virus in the blood of the donor horse, the number of vectors subsequently feeding on the uninfected horse after being interrupted while feeding on the infected horse, the volume of the donor's blood that is transferred on the mouthparts of the insect vectors to the uninfected horse and the amount of the virus which remains infective after the time interval before transmission (Issel and others, 1990).

Historically, other potential routes of transmission have also been considered. They may include transplacental transmission (documented infrequently) and venereal transmission by semen of stallions with acute clinical signs (a theoretical possibility) (Issel and others, 1990). Direct contact is highly unlikely to play a role in the transmission of the virus although the virus may be present in secretions and excretions of infected horses (Umphenour and others, 1974, Issel and Coggins, 1979) as well as blood.

Iatrogenic spread through mechanical transmission of infected blood by hypodermic needles and syringes is less likely since the introduction of the practice of 'one needle - one horse' and other precautionary measures such as testing for EIA before horses are used as blood donors (Issel and others, 1990).

5 Conclusions

EIA is considered to be present in Russia, the Balkan countries, Romania and Turkey. Therefore, there is an increased likelihood of the introduction of the disease to neighbouring EU Member States, particularly by illegal movement of horses. This emphasises the importance of maintaining appropriate border control measures in these EU Member States.

Historical records in the EU show that sporadic cases of EIA have been detected in several EU Member States. However, the most of these cases appear to have involved a limited number of infected horses and rarely resulted in lateral transmission to susceptible horses. All these episodes appear to have been effectively controlled at the time and did not result in any epizootics in the affected Member States.

The EIA status of the most of the EU horse population remains largely unknown given that this population is not usually subject to close monitoring or testing. Only a relatively small percentage of the EU horse population (e.g. mainly racing horses) is closely monitored or tested for EIA. Nevertheless, the health statement requires all horses that move within the EU to be clinically examined and declared healthy prior to movement.

It is likely that EIA may be present at a low level in those populations of horses that are not usually closely monitored or tested, given that horses may be inapparently infected and show no clinical signs of the disease. There is a low likelihood that inapparently infected horses may be examined, assessed as clinically healthy and then allowed to move between Member States. On the one hand, such horses may provide a source of the virus for horses that are unlikely to be monitored and where infection is unlikely to be detected and notified. On the other hand, they also may be a source of infection for horses that are closely monitored and where infection is likely to be detected and notified. However, in both cases the introduction of the virus to the horse population of the UK would be a chance event subject to optimal conditions for the transmission of the virus being fulfilled.

Movement of live horses within the EU does not require horses to be tested for EIA, but they must come from a holding free from EIA. Italy appears to be the only EU Member State that reports cases of EIA relatively regularly. These events are subject to EU rules. That is, once the infection has been detected at a premises, EU rules do not allow movements of horses from the premises until certain conditions (i.e. no new cases for the past three months since the last case and horses subjected to two negative tests three months apart) are fulfilled to show freedom from the disease.

The requirement for health certificate and clinical examination prior to movement does not apply to movement of registered horses under TPA. Regardless, registered horses are subject to close monitoring and management. Therefore, the introduction of the virus to the UK by registered horses showing clinical signs is unlikely. However, there is a low likelihood that some of these horses may also be inapparently infected, may move from another Member State and could introduce the virus to the UK. As above, the introduction of the virus to horse population in the UK is considered to be a chance event subject to the fulfilment of optimal conditions for the transmission of the virus. This highlights the

importance of applying good management practices and appropriate biosecurity (e.g. mingling with horses of unknown EIA status) measures on the part of industry and veterinary profession involved in dealing with registered horses in order to mitigate their potential exposure to other horses with uncertain health status.

It is likely that the introduction of the virus to the UK would result in local spread under optimal conditions (i.e. mixing with other horses, abundance of biting flies). However, whether this local spread is likely to result in the wider distribution of the virus in the UK would greatly depend on the movements of the initially infected horse or horses and any other horses that have been in-contact and subsequently become infected.

6 References

- Cvetnic, S. (1983). Virusne bolesti zivotinja (Viral diseases of animals). Stvarnost-JAZU, Zagreb, 1983.
- Darcel, C. (1996). Equine Infectious Anemia in Alberta. Canadian veterinary Journal, Vol.37, 583.
- Issel, C.J., McManus, J.M., Hagius, S.D., Foil, L.D., Adams, W.V., Jr., Montelaro, R.C. (1990). Equine infectious anemia: prospects for control. Development in Biological Standards, Vol.72, 49-57.
- Issel, C.J., Rushlow, K., Foil, L.D., Montelaro, R.C. (1988). A perspective on Equine Infectious Anemia with an emphasis on vector transmission and genetic analysis. Veterinary Microbiology, 17, 251-286.
- Issel, C.J., Adams, W.V., Foil, L.D. (1985). Prospective study of progeny of inapparent equine carriers of equine infectious anaemia virus. American Journal of Veterinary Research, Vol.46, No.5, 1114-1116.
- Issel, C.J., Foil, L.D. (1984). Studies on equine infectious anemia virus transmission by insects. Journal of the American Veterinary Medical Association, 184, 293
- Issel, C.J., Adams, W.V., Meek, L., Ochoa, R. (1982). Transmission of equine infectious anaemia virus from horses without clinical signs. Journal of American Veterinary Medical Association, Vol.180 (3), 272-275.
- Issel, C.J., Coggins, L. (1979). Equine infectious anemia: current knowledge. Journal of American Veterinary Medical Association. Vol.174, No.7, 727-733.
- Kemen, M.J., McClain, D.S., Matthyse, J.G. (1978). Role of horse flies in transmission of equine infectious anemia from carrier ponies. Journal of American Veterinary medical Association, Vol.172, No.3, 360-362.
- Foil, L.D., Meek, C.L., Adams, W.V., Issel, C.J. (1983). Mechanical transmission of equine infectious anemia virus by deer flies (*Chrysops flavidus*) and stable flies (*Stomoxys calcitrans*). American Journal of Veterinary Research, Vol.44, No.1, 155-156.
- Hall, R.F., Pursell, A.R., Cole, J.R., Youmans, B.C. (1988). Clinical Reports. A propagating epizootic of equine infectious anemia on a horse farm. Journal of American Veterinary and Medical Association, Vol.193, No.9., 1082-1084.
- Hawkins, J.A., Adams, W.V., Wilson, B.H., Issel, C.J., Roth, E.E. (1976). Transmission of Equine Infectious Anemia Virus by *Tabanus fuscicostatus*. Journal of American Veterinary medical Association, Jan 1,168(1):63-64.
- Paquette, B. (1985). A retrospective study of equine infectious anemia based on the Canadian control program. Canadian Veterinary Journal, No. 26, 373-377.
- Umphenour, N.W., Kemen, M.J., Coggins, L. (1974). Equine infectious anemia: a retrospective study of an epizootic. Journal of American Veterinary Association, Vol.164, No.1, 66-69.