Equine Exotic Diseases

A manual for horse owners

A Report for the Rural Industries Research and Development Corporation

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Foreword

Everyone has a role in protecting Australia from foreign diseases and pests. The outbreak of foot-and-mouth disease in the United Kingdom during 2001 has been a timely reminder of the devastation that the introduction of a serious exotic disease can bring to a country. The direct economic costs have reached the billions of pounds, but the added social and welfare costs to British society cannot be estimated or understated. Although foot-and-mouth disease virus does not infect horses, the outbreak had far reaching consequences, and the Australian horse industry was also affected. Evidently the introduction of a serious disease that directly infected horses could have greater consequences for our equine industry, some of which may be long term.

All horse owners need to be aware of the threat posed by equine exotic diseases and to play a role in maintaining vigilance against their introduction. In Australia, we are fortunate to be free of many of the serious infectious diseases that can affect horses. A large part of this freedom is due to our strict but fair quarantine regulations, but it is up to all of us to help maintain this privileged position.

Those working with horses on a day-to-day basis should read this manual and appreciate the seriousness of an exotic disease reaching Australia. The manual will tell you what you can do to help minimise the likelihood of this occurring. The horse owner should also appreciate that any newly imported horse, or horses contacting a newly imported animal, which becomes ill should be attended to immediately, and the appropriate authorities contacted. The horse owner should be able to recognise unusual or unexpected signs in their horses, and they should know what to do if they suspect an exotic disease. It is important that we have vigilant horsemen and women to help our preparedness against exotic diseases in order to protect our growing equine industry.

This report, a new addition to RIRDC's diverse range of over 800 publications, forms part of our Horse R&D Program, which aims to assist in developing the Australian horse industry and enhancing its export potential.

Most of our publications are available for viewing, downloading or purchasing online through our website:

- Downloads at www.rirdc.gov.au/reports/Index.htm
- Purchases at www.rirdc.gov.au/eshop

Peter Core
Managing Director
Rural Industries Research and Development Corporation

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Contents

List of tables

List of figures

Abbreviations and acronyms

AAHL	Australian Animal Health Laboratory
Ab	Antibody
AFFA	Agriculture, Fisheries and Forestry Australia
Ag	Antigen
AHA	Animal Health Australia
AHS	African Horse Sickness
AI	Artificial Insemination
AUSVETPLAN	Australian Veterinary Emergency Plan
CEM	Contagious Equine Metritis
CNS	Central Nervous System
CSF	Cerebrospinal Fluid
EAV	Equine Arteritis Virus
EE	Equine Encephalosis
EEE	Eastern Equine Encephalomyelitis
EGE	Equine Granulocytic Ehrlichiosis
EHV-1	Equine Herpes Virus-1
EHV-4	Equine Herpes Virus-4
EI	Equine Influenza
EIA	Equine Infectious Anaemia
EPM	Equine Protozoal Myeloencephalitis
EU	European Union
EVA	Equine Viral Arteritis
VEE	Venezuelan Equine Encephalomyelitis
JE	Japanese Encephalitis
OIE	Office International des Epizooties
PAQ	Post Arrival Quarantine
PCR	Polymerase Chain Reaction
PEQ	Pre Export Quarantine
PHF	Potomac Horse Fever
QEAC	Quarantine Exports Advisory Council
USDA	United States Department of Agriculture
VS	Vesicular Stomatitis
WEE	Western Equine Encephalomyelitis
WNV	West Nile Virus

Executive summary

Australia is in the privileged position of being free of many of the serious infectious diseases of horses that are found elsewhere in the world. This freedom has occurred as a result of our relative isolation and to the diligence of our quarantine services. However, in this era of increasing globalisation and international movement of horses, the risk for introduction of an exotic disease to our equine population is increasing. Naturally, it is important to recognise the benefits that the Australian horse industry has received due to the movement and trade of horses and semen. However, it is equally important to ensure our continued freedom from these serious infectious diseases. In order to prevent their entry to Australia everyone in the horse industry has a responsibility and must play a part.

There are a number of simple but important things that we can all do to help stop the introduction of an exotic disease:

1. Know ***which diseases of horses are exotic to Australia***.
2. Know ***which of these exotic diseases are most likely to be introduced to Australia***.
3. Know how these ***diseases may be introduced*** to Australia and ***how they may spread*** around the country if they are introduced.
4. Be able to ***recognise*** the (clinical) ***signs that an infected horse*** may have.
5. Know ***who to contact*** should you suspect an exotic disease and remember if you "***see anything usual"*** then ***"look, check and ask a vet***…"
6. Know the ***procedures*** that should be done when any newly introduced horse is brought onto a property, but particularly an imported horse.
7. Understand the ***risk factors*** that may help to increase the likelihood for the introduction of an exotic disease.
8. Understand the ***consequence of an outbreak*** of an exotic disease.

The goal of this manual is to make everyone that comes into contact with horses familiar with the exotic diseases that can affect this species and to outline what you can do to help prevent the introduction of these diseases to our country. It is only with the vigilance of all those involved in the industry that our horses can remain free of these important diseases.

1. Introduction

Exotic or foreign diseases are those diseases that are not usually present in Australia, and that are introduced from another country, either temporarily or permanently. These diseases are caused by infectious organisms, such as viruses, bacteria, fungae or parasites. The effects of an outbreak of a serious exotic disease are manifold and involve not just the people who own affected horses, but many other areas of the community. Although the economic effects are most obvious and can be tremendous, the social and welfare consequences are equally as important and significant. An outbreak of a serious exotic disease could be disastrous for our equine industries, which could lose millions of dollars in trade and employment, as well as potentially having major loss of equine lives.

The recent introduction of foot-and-mouth disease virus to the UK has provided a dramatic example of an outbreak of a serious exotic disease and the effect such an outbreak can have on all aspects of society. The direct economic losses for livestock producers amounted to billions of pounds, and the economic and social consequence within the wider community were also immense. In addition, the devastating loss of animal's lives will be long remembered. Although horses do not suffer from foot-and-mouth disease[89], effects from this outbreak were also felt by the horse industries both in the UK and Australia. It has helped remind us, in a most alarming way, of the overwhelming consequences that an outbreak of a serious exotic disease can have on a particular industry, as well as the community at large.

The only way to be certain of keeping exotic diseases out of a country is to close all borders to all traffic, including humans and horses. This is simply not feasible, nor is it desirable. The trade in, and movement of, horses has provided many benefits to our equine industries, as well as to the community at large. Imagine not having the opportunity for the Australian 3DE team to jump to golden success in the Sydney Olympic Games, which would not have occurred if foreign (or foreign-based Australian horses) were not allowed to enter Australia for the Games. However, if we wish our country to remain free of the many serious horse diseases that occur in other countries, we need to remain vigilant. The best way to do this is for the **ENTIRE** industry to help prevent the introduction of an exotic disease and this requires the co-operation of **ALL** people associated with horses. We need to follow rigorously the regulations governing importation of horses into Australia, as well as be aware of the alternate ways that these diseases may be introduced. We need to recognise when unusual or unexpected signs occur in our horses ***(remember to "think the worst first")*** and, **MOST IMPORTANTLY**, who to contact should we suspect an exotic disease. Prompt action by horse owners will greatly diminish the chance for an exotic disease to spread. In these ways we can all play a vital role in ensuring our continued freedom from these major horses diseases.

This manual is directed at everyone involved with horses and who may come in contact with an exotic disease. This includes owners, trainers, jockeys, riders, breeders, farriers, saddlers, veterinarians, and transporters. The manual covers a range of issues concerning exotic diseases, as well as the diseases themselves. In addition, a list of references and useful web sites can be found at the end of the manual for those of you wanting further information. Finally, a glossary of terms used in the manual has been included and which provides definitions of some of the more technical (veterinary) terms. It is the intention of this manual to highlight the key aspects of equine exotic diseases so that we may better understand their importance and all play a role in preventing their introduction to our horses.

1.1 What are the horse diseases that are exotic to Australia

Horse owners in Australia are fortunate in that there are many infectious diseases of horses that are not found in our country. A complete list of these diseases is provided in **Table 1**, and the major diseases are discussed in more detail in Section 5 of the manual. In addition to the ***exotic diseases*** listed in Table 1, some of the ***horse diseases that are present in Australia*** and which may have importance for equine industries in other countries have been listed. These diseases are officially recognised by the Office International des Epizooties or OIE (the organisation for World Animal Health) as they have implications for the international trade of horses. The OIE listing (List A or B) has been included in this table. More information regarding the OIE and its List A and B diseases is given in the section "How are exotic diseases monitored worldwide?"

1.2 What is at risk if an exotic horse disease were introduced?

If a serious exotic disease were introduced to our horse population, there could be a significant disruption to a large segment of our community. In order to appreciate the extent that this disruption may have, an understanding of the size of the equine industry, and its contribution to our economy, is required. Three publications have significantly added to our knowledge of the Australian horse industry[5,45,115]. However, these publications note that there remains a great deal that is unknown about the entire industry and that these facts and figures would assist in the assessment of the economic and social impact of an outbreak of an exotic disease as well as helping with its management and control.

1.2.1 The equine industry is a large industry

Although there are a number of individual sectors to the equine industry (racing, breeding, equestrian organisations, events and businesses), these various groups are increasingly seeing themselves as a single industry, with many common goals. Together, they create one of the largest industries within Australia, and one that contributes significantly to both our economic and social well being.

- There are between 0.9 to 1.5 million horses in Australia today, including ~ 300,000 to 600,000 feral horses[45].

- Together, the equine industries directly employ about 50,000 people, and many hundreds of thousands more participate in horse riding activities, either as riders or as volunteers.

- The introduction of a serious exotic equine disease to Australian could have a major impact on how this industry was run on a day-to-day basis, and could even result in it being completely "shut down". If this happened it would have serious consequences for those people whose livelihood derives from the horse industry.

Table 1.1: List of the horse diseases that are exotic to Australia, and some diseases of horses that occur in Australia.

DISEASE	Present in Australia	OIE Listing[Ψ]
African Horse Sickness (AHS)	-	A
Vesicular Stomatitis (VS)	-	A
Equine Influenza (EI)	-	B
Rabies	-	B
Japanese Encephalitis (JE)	-[♱]	B
Equine Viral Encephalitides (EEE,WEE,VEE)	-	B
Equine Babesiosis (Piroplasmosis)	-	B
Contagious Equine Metritis (CEM)	-	B
Surra	-	B
Dourine	-	B
Epizootic Lymphangitis	-	B
Glanders	-	B
Horse Pox	-	B
Horse Mange	-	B
Echinococcus granulosus var *equinus*	-	B
Trichinellosis	-	B
West Nile Virus (WNV)	-	-
Equine Protozoal Myeloencephalitis (EPM)	-	-
Potomac Horse Fever (PHF)	-	-
Equine Granulocytic Ehrlichiosis (EGE)	-	-
Equine Encephalosis (EE)	-	-
Borna Disease	-	-
Getah	-	-
Salmonella equi abortus	-	-
Lyme Disease	-	-
Nagana	-	-
Louping Ill	-	-
Nipah Virus	-	-
Equine Arteritis Virus (EAV)	+[ω]	B
Equine Infectious Anaemia (EIA)	+	B
Equine Rhinopmeumonitis (EHV-1 abortion)	+	B
Corynebacterium pseudotuberculosis (Pigeon Fever)	+[ω]	-

[Ψ] Definitions of OIE List A and B diseases are in the section "How are exotic diseases monitored worldwide?"

[♱] JE is present in the Torres Strait

[ω] Strains of equine arteritis virus (EAV) and *C. pseudotuberculosis* are present in Australia, but not those causing disease in horses

1.2.2 Economic importance of the equine industry

The horse industry is estimated to contribute approximately $6.3 billion annually to the Australian Gross Domestic Product (GDP) every year[45]. This figure does not include voluntary labour, estimated to be worth another $1.7 billion. This contribution is derived from horse related business activities (including wagering), events, and expenditure on horse maintenance (stabling, feeding, training, farriery, veterinary and pharmaceutical costs etc).

- This economic contribution to the GDP compares with the livestock industry and is about 1/3 the size of the total contribution of the agriculture, fisheries and forestry industries.

- Wagering on thoroughbred horse racing alone totalled $9.6 billion in 2000/2001[5] and over $11.6 billion is wagered annually in Australia on horses[45].

- Based on an average tax rate of 25%, income taxes on labour would contribute $100 million in federal government revenue and there is approximately $60 million in export earnings annually[45].

1.2.3 Likely direct costs of an equine exotic disease

If a serious exotic disease were introduced to Australian horses it could significantly disrupt the way our horse industry goes about its business. There could potentially be a complete ban on all movement of horses, ban on running all equestrian events, quarantine of infected premises, tracing and surveillance of all contact horses, and mass vaccination. The livelihood of many in the industry could directly suffer, and the effect of such an outbreak on our trade in horses, particularly our ability to export horses, could potentially be long term.

- A recent report[128] commissioned by Animal Health Australia examined the **likely costs** of an emergency response to a ***hypothetical outbreak of equine influenza***. The scenario chosen was an outbreak of disease in Victoria arising from a minor breach of quarantine procedures. The hypothetical outbreak was detected early and eradicated before it became widespread. The emergency response was based on quarantine of infected premises, cessation of all horse movement and assembly, tracing and surveillance of contacts, and vaccination of all horses of all breeds on dangerous contact premises and within a restricted area. It was estimated that a total cost of such a response to a limited outbreak involving three infected premises would be ~$775,840 without vaccination of all Thoroughbred and Standardbred racehorses in training in Victoria, and $3,740540 if all racehorses in training were vaccinated (assuming an adequate supply). Response costs for an alternative scenario involving a larger scale outbreak (30 infected premises) and vaccination of all racehorses in Victoria, was estimated to be $6,136,410.

- It should be noted that the cost of vaccination in this scenario has only included racehorses and not all breeds of horses, which would entail far greater costs.

- It is evident that an incursion of certain equine exotic disease could easily reach into the millions of dollars, and this does **not** include the loss of revenue from cancelled events, the loss of wagering revenue or the loss of income for many involved in the horse industry.

- In the event of a **real** outbreak of an equine exotic disease, the arrangements regarding cost sharing are currently being brokered by ***Animal Health Australia***[32]. Under the proposed ***cost sharing deed of arrangement for emergency animal diseases***, the costs eligible for sharing only include salaries and wages for personnel involved in the response to the disease, operating expenses (including laboratory costs and surveillance), capital costs and compensation for animals and equipment. The consequential losses arising from cancellation of events, loss of income etc is NOT covered by the agreement.

- In addition, under this agreement, different diseases involve different cost sharing arrangements. For example, if an outbreak of equine influenza were to occur the costs would be shared 20% by the government, and 80% by the horse industry[32]. This is because equine influenza is a Category 4 disease. This category of disease has been defined as one having low public benefits in as much as an outbreak would mainly cause production losses, potential losses for international trade, and local market disruptions. However, diseases in Category 4 are not regarded as ones that would significantly affect the national economy. In addition, in the event of a Category 4 disease, the main beneficiaries of a successful emergency response to an outbreak would be the affected livestock industry (horses industry), as equine influenza does not affect other species.

- A means of finding funds to pay the horse industry's share of response costs has yet to be established[32]. Furthermore, currently only the Australian Racing Board is a potential signatory to the new Agreement. An inclusive mechanism to fund a response involving the whole horse industry has yet to be developed.

- Finally, the report noted that the "horse industry can have no assurance that the state authority will initiate an emergency response to an outbreak of an equine disease without some mechanism in place for the industry's share to be paid. In the absence of a rapid and effective response to an emergency disease situation there is a likelihood of the disease becoming established and widespread, with control and treatment costs being an ongoing expense to all sectors of the horse industry"[128].

1.2.4 Disruption to recreational activity for many people

In addition to the economic costs of an outbreak of an exotic disease, there would be social costs for a large group of people. The horse industry has undergone an unprecedented and remarkable resurgence in the past 10 to 15 years in many countries around the world, including Australia. Undoubtedly, part of this resurgence can be contributed to an increased interest in the horse as a ***leisure or recreational animal***.

- There are approximately 275,000 horse owners in Australia[45].

- In addition, about 250,000 people participated in horse riding activities in 1998-99, though it is thought that this probably vastly underestimates the number of people riding horses annually[45].

- The number and diversity of people participating in equestrian events is typified by the large numbers of Associations, Breed Societies and Clubs that occur in Australia, which includes Jockey and Racing Clubs, Owner's Associations, Trainer's Associations, Royal Agricultural Show societies, Event Councils, Equestrian Federation of Australia, Polo and

Polocrosse Clubs, Pony Club, Dressage Clubs, Riding for the Disabled, Endurance Riders Associations, Vaulting Clubs, Campdraft and Rodeo Riders Associations, Showjumping Clubs, Harness Horse Associations, National Pleasure Horse Association, National Saddle Horse Association, and National Reining Horse Association.

If a serious exotic disease were introduced to Australia, there is the possibility that all horse events in a region or state could be cancelled for a period of time and the movement of horses from one place to another could be stopped. Evidently, the introduction of a serious exotic disease could greatly disrupt the pleasure activity of a large number of people.

1.2.5 Restriction on international trade and competition

There are significant numbers of horses imported into, and exported from Australia each year. The trade in horses is largely driven by the breeding and competition (racing, equestrian events) sectors and has grown significantly in recent years with the advent of "shuttle" stallions in the thoroughbred breeding industry, and the inclusion of international horses in events such as the Melbourne Cup and the Olympic Games.

- The latest figures available for trade of Australian horses estimate that in the year 2000 there were approximately 5,000 horses imported (with an estimate of worth of $96, 600 million), and approximately 3,000 horses exported (with an estimated worth of $92,000 million)[45].

While the Australian horse industry derives many benefits from the importation of horses, it is not without some inherent risks for the introduction of exotic diseases. The incursion of a serious exotic disease into Australia could potentially shut down this section of the industry, and may have long ranging consequences for subsequent importation and exportation of horses.

1.3 What are the risk factors?

Risk factors are characteristics that help **predispose** to the introduction of an exotic disease. There are a number of risk factors that have been shown to affect, or have the potential to alter, the global distribution of equine infectious diseases. The factors influencing the international spread of equine diseases were recently reviewed[149] and included:

1.3.1 International movement of people

Australians are travelling abroad at an ever-increasing rate. Through international travel, people can be responsible for the introduction of exotic diseases, both human and animal, into Australia. This may include people that have had contact with horses whilst overseas, and also those who have not come in contact with horses. Returning travellers may be carrying organisms, either on themselves or in their luggage, that can infect a range of species, not just horses. Therefore it is essential for all Australians returning from trips abroad to strictly adhere to all quarantine regulations upon their return. This includes completing the ***arrival declaration forms*** carefully and honestly and ***discarding*** any animal or plant product that you have not declared in the appropriate bins provided. It would only take one person not adhering to these important regulations that could jeopardise not only the equine industry, but other agricultural industries as well as our native flora and fauna.

1.3.2 International movement of horses and semen

In the past 30 to 40 years there has been an unparalleled growth in the international movement of horses and semen[148,150]. This has been largely facilitated by the advent of jet transportation, which has revolutionised the ease and speed with which horses could be shipped between and within countries. It is interesting to note that apart from people, horses travel internationally more than any other species[149] and more and more countries are becoming involved in the movement of, and trade in, horses and semen, especially since the early 1990's. Although there are many benefits from the international movement of horses and semen, the fact that many more horses are moving around the globe, and at a rapid speed (shorter times than the incubation periods of many diseases) increases the risk of introduction of infectious diseases to a country.

There are a number of considerations regarding the international movement of horses which include:

1.3.2.1 Why horses are moved?

- Horses are transported internationally for a variety of purposes, and may be imported into a country on a ***temporary or permanent basis*** (**Figures 1 and 2**).

- The movement of horses between countries most often takes place for ***competition or breeding purposes.***

- Competitions are involving an increasingly divergent range of performance activities, including racing, show jumping, dressage, eventing, driving and endurance riding.

- The shipment of mares and stallions ("shuttle stallions") for breeding is a relatively recent phenomenon, and predominantly applies to the Thoroughbred industry in which artificial insemination is not currently sanctioned, but other equine breeds are also involved.

- Movement of horses nationally and internationally can also take place for ***sale purposes*** or in the event of a change in an animal's ownership.

- The final, and most controversial reason to transport horses internationally is for slaughter, and the provision of meat for human consumption[149]. Australia does not export horses live for slaughter, rather horses are slaughtered in export accredited abbatoirs[45] and the horse meat is exported. Horsemeat cannot be sold for human consumption in Australia, although it can be sold for pet meat[45].

Figure 1: Loading a horse into a jet stall for international travel

Figure 2: Loading the jet stalls into an aeroplane

1.3.2.2 Factors influencing the international trade in horses and semen

- The single most important factor to influence the expansion of trade in horses has been the ***increasing economic significance of the horse industry*** in a growing number of countries, especially in the last 15 years[150].

- In addition, there has been a ***change of trends within the horse industry*** with an increasing number of prestigious and lucrative racing and competition events held in different countries. Horses are being shipped around the world to compete in individual events such as the Breeders Cup, the Melbourne Cup, competition racing circuits such as the Emirates World Series Racing Championship, and events such as the World Championships and Olympic Games. There is likely to be further proliferation of events like these in the future.
- Another important development that has gained increasing momentum in recent years is the commercial practice of ***dual-hemisphere breeding*** of stallions[132,150]. Most of the

stallions involved are shuttled between the Northern and Southern hemispheres, fulfilling a breeding season in each hemisphere in the same calendar year, before returning to their country of origin. Stallions have been shuttled from Ireland, USA, UK, France, Japan and Canada, primarily to Australia, and to a lesser extent New Zealand, South Africa, Argentina, Chile, Brazil, Colombia, Peru, and Venezuela, with the number of stallions shuttled in any one year rising dramatically from 7 in 1989 to just over 100 in 2000[149].

- A final significant trend that has taken place in recent times is the ***acceptance of artificial insemination*** by an increasing number of breed registries; the Thoroughbred remaining the only major equine breed in which this practice is not currently sanctioned by the appropriate studbook authorities[149]. As a consequence, the international trade in frozen semen has grown considerably, as breeders take advantage of pre-eminent bloodlines in other countries to improve the genetic quality of particular breeds in their own country.

1.3.2.3 Disease risks inherent in international movement

- ***International movement of horses is the single most important factor contributing to the global spread of equine infectious diseases***[148,150]**,** and the risk of dissemination of these diseases has increased with the progressive growth in the international trade of horses and shipping of semen[151].

- As a result, there have been a number of instances in recent years where outbreaks of specific infectious diseases have been associated with the importation of infected animals or infective semen into a country [148,149].

- ***Australia has strict quarantine regulations*** for the importation of horses either temporarily or on a permanent basis. These rigorous regulations have facilitated our continued freedom from many of the major equine infectious diseases that are found around the globe, whilst permitting the movement of horses.

1.3.3 New or emerging diseases

Another risk factor for the introduction of an exotic disease to Australia is the occurrence of new or emerging diseases. Alternatively, the new or emerging diseases may occur in Australia. Over the past 30 to 40 years a number of new diseases, or old diseases that were rarely seen, have emerged and have been shown to affect horses[148,151,152]. This ***list of new or emerging diseases*** includes several viral infections (e.g West Nile virus, Getah virus, Hendra virus and Nipah virus); bacterial diseases (e.g Potomac horse fever, equine granulocytic ehrlichiosis) and parasitic infections (e.g equine protozoal myeloencephalitis).

The geographic distribution of most of these diseases has not changed appreciably since they were originally identified. In addition, most of these diseases don't occur in Australia. However, these diseases remain a concern as frequently little is known about their causative agents. Consequently, future control over the spread of these emerging diseases will require further research to better understand the diseases that they cause and the ways that these agents may be transmitted.

1.3.4 New biotypes of recognised pathogens

The emergence of new biotypes (strains) of recognised equine pathogens through spontaneous mutations is an infrequently recorded occurrence. However, such events may enhance the ***risk of spread of these agents*** to other countries or regions of the world and alter the previously known geographic distribution of particular diseases. For example, in 1989; a ***new strain of equine influenza*** virus emerged in China and is believed to have been of avian (duck) origin[48,163]. Although this virus did not spread outside China, it demonstrates the ability of influenza viruses to occasionally cross species. This is of importance as it may represent a mechanism by which a new strain of influenza virus is introduced to a country.

More recently, ***major outbreaks of Venezuelan equine encephalitis (VEE)*** were recorded in southern Mexico, where the outbreak was linked to the emergence of a new VEE virus subtype 1E that had evolved from the local (endemic) virus of the region[105]. This new strain was of significance as it was capable of inducing considerable morbidity and mortality in horses[105,127]. Although this particular outbreak was largely confined to Mexico, other outbreaks of VEE have been associated with emergence of new pathogenic strains derived from the local virus, and have spread further afield, including Southern and occasionally Northern America[127].

1.3.5 Introduction of arthropod vectors to Australia

The inadvertent introduction of an arthropod vector (e.g. species of mosquito or tick) into Australia could also influence the occurrence and distribution of some exotic diseases that are transmitted to horses by arthropods. These diseases are ones in which the organism survives and multiplies within an insect host (arthropod vector) and is then transmitted by the insect to other hosts (e.g. horses or humans) when it bites and feeds on them. It is very important that these arthropod vectors are not allowed to enter Australia, as if the arthropod vector is not present in Australia, then the exotic disease cannot become established.

There are a number of occasions when an arthropod vector has been introduced to a country, has become established and has had a subsequent impact upon the distribution of disease. For example, within the last 10 – 15 years, two species of mosquito have been introduced to the US, most probably as stowaways on shipments of old tyres from Asia[50,51]. Both introduced species are considered to be competent vectors of various viral diseases, and one of them is thought to be involved in transmission of ***Eastern equine encephalitis (EEE***) virus in south west USA[151], and the other in transmission of ***West Nile virus (WNV)*** among native wild bird populations[51].

1.3.6 Migration of reservoir hosts or vectors of specific pathogens into Australia

For many years, species of migratory birds were believed to be instrumental in the introduction or re-introduction of certain diseases into countries in which these diseases were not normally found[18,80,165,]. A good example of a disease that may be spread in this fashion and that may affect horses is ***West Nile virus*** infection. This virus is usually spread between birds and mosquitoes. However, it may also occasionally affect horses and humans, causing significant disease as well as occasional deaths. There is considerable evidence that West Nile virus has spread into new areas of Southern Europe through the migration of birds[124.] In addition, the ***recent introduction of West Nile virus to North America***, although the subject

of much speculation, is believed to have been through the introduction of a pet, domestic or wild bird through normal migration, displacement from normal flight paths by storms, or legal or illegal importation[124.] It is anticipated that this virus will spread further within the Americas as there are four major bird migration routes that pass through the areas of the USA in which cases of West Nile virus now occur[124]. The long-term threat of this viral infection to these countries' highly valuable equine industries, although difficult to assess at the present time, is likely to be significant.

Further examples of the influence that migration of insect vectors has on the occurrence and distribution of arthropod-borne equine diseases are ***African horses sickness*** and ***Japanese encephalitis virus***. African horse sickness has been spread over considerable distances through wind-borne carriage of infected *Culicoides* spp[149], and it is through this mechanism that the disease is thought to occasionally spread to parts of Northern Africa, the Middle East and the subcontinent. Similarly, infected wind blown mosquitoes from Papua New Guinea are considered to be the most likely source for the periodic incursions of ***Japanese encephalitis virus*** into the Torres Strait Islands and Cape York Peninsular[31] and are a particular threat for Australian horses.

1.3.7 Climate related phenomena

The influence of certain climate-related phenomena such as ***global warming***, the ***El Nino-Southern Oscillation*** and ***La Nina***, on the distribution and spread of various human and animal diseases has become a subject for increasing speculation[79,92,141]. Although there remains some controversy as to the extent of global warming, the resulting disturbance of complex biological systems may influence the incidence and distribution of certain infectious diseases, especially those that are vector borne such as the viral encephalitides[72,79,93]. Increased temperature and altered rainfall are likely to affect the range and biological behaviour of vector organisms and intermediate, amplifying, or reservoir hosts as well as the viability and maturation rates of infective agents. For example, there is growing evidence that the unusual weather patterns characteristic of El Nino may influence the incidence and distribution of certain human and animal diseases such as Rift Valley Fever, hantavirus pulmonary syndrome, and African horse sickness[11,79,162]. This has relevance for countries like Australia, where the effects of El Nino and La Nina are commonly felt. Further studies are needed to define more closely the nature of climate-disease linkages if countries are to be in a better position to predict the potential effects of major climate changes on human and animal health[149].

1.4 How do we assess the risk for introduction of an exotic disease?

The assessment of risk (ie likelihood) for the introduction of exotic disease into Australia, its likely establishment, and the possible consequences were an exotic disease introduced, is very complicated. However, it is important to estimate this risk as it influences our policies for trade and quarantine of animals, including horses. Risk assessment may be done for specific horse diseases, or it may be a part of a larger assessment of risk for the introduction of exotic diseases affecting many of our domestic animals.

It is important to remember that ***risk assessments may be quickly outdated*** as our world changes with increasing globalisation. This change may be associated with the emergence of

new or altered infectious agents, the changing geographical distribution of diseases, changing global climate, or due to new ways of investigating diseases. Thus a disease that may not have been discovered 10 years ago, or may not have been considered important, may now pose a major threat. Consequently, our risk assessments are under frequent scrutiny.

1.4.1 Import risk analysis

Risk analysis is the technique that is used to assess importation risk[139]. Import risk analyses are used for the identification, assessment and management of risks associated with the importation of animals (including horses) and animal-derived products, and included identification of:

- ✓ the likelihood of a disease entering, establishing or spreading in Australia,
- ✓ the likelihood that harm will result to animals, plant and human life or health, and the environment if a diseases were introduced,
- ✓ the likely extent of that harm.

Importation is only permitted if the risks can be managed. The import risk analysis process is a transparent one, and draft reports of the risk analysis are widely distributed within the community for comment and evaluation.

Import risk analyses are conducted by **Biosecurity Australia** within **Agriculture, Fisheries and Forestry Australia (AFFA)**. This group have produced a Handbook[12] that describes the administrative processes that are followed when conducting an **import risk analysis**. More recently AFFA has reviewed the current process, together with the Quarantine and Exports Advisory Council (QEAC) and after consultation with stakeholders, a new edition of the handbook will be published in 2002. The administrative framework is designed to ensure that the Government's biosecurity objectives are met, in that:

- ✓ There is sound scientific basis for biosecurity policies
- ✓ Importation is only permitted when the risks posed can be managed in a manner consistent with Australia's highly conservative approach to pest and disease risk
- ✓ Stakeholders have had reasonable opportunities to contribute to the outcomes of the import risk analysis
- ✓ Stakeholders are aware of the reasons for new or revised policies.

It is important to note that the primary purpose of biosecurity is to protect Australia from the entry, establishment and spread of unwanted pests and diseases while minimising restrictions on the entry of agricultural commodities. The unwanted pests and diseases may cause social, economic or environmental damage and therefore it is important to have security measures to keep them out of this country. Due to Australia's unique and diverse flora and fauna and the value of its agricultural industries, successive Australia governments have maintained a highly conservative, but not zero risk approach, to the management of biosecurity risks. In this context, risk analysis is regarded as ***"the foundation stone on which all quarantine policy and action must be built…"***.

1.5 How are exotic diseases monitored world wide?

1.5.1 Office International des Epizooties (OIE)

The Office International des Epizooties (OIE), the world organisation for animal health, is an inter-governmental organisation created by an international agreement on 25th January, 1924 and which was originally signed by 28 countries. As of May, 2001 there are 158 Countries that are cosignatories. The head office of the OIE is in Paris, France. Its mission is to guarantee the transparency of animal disease status world wide through the collection, processing and dissemination of data relating to important animal diseases[143]. To this end, each member country (including Australia) must undertake to report the animal diseases that it detects on its territory. The OIE then disseminates this information to other countries so that they may take necessary preventative action to ensure that these diseases are not spread globally. This information also includes diseases transmissible to humans. Information is sent out periodically (weekly, bimonthly or annual) or immediately, depending on the seriousness of the disease. Dissemination is via the OIE website (http://www.oie.int), email and periodicals (bulletins).

In addition to its role in monitoring animal diseases on a global basis, the OIE collects and analyses the latest scientific information on animal disease control. This information is made available to member countries to help improve methods used to control and eradicate these diseases. The OIE also develops documents relating to rules that Member Countries can use to protect themselves from diseases, without setting up unjustified sanitary barriers. The main documents produced by the OIE include "International Health Code" and the "Manual of Standards for Diagnostic Testing and Vaccines". OIE standards are recognised by the WTO as a reference for international sanitary rules. The OIE also publishes the Animal Health Code, which is the recognised international standard providing health guarantees required of trading partners to avoid the risk of disease transmission through trade in live animals and animal products.

1.5.1.1 List A and B diseases

The OIE have identified two groups (lists) of diseases that they consider to be of particular importance due to their ability to spread between or within countries, potential economic significance, and public health importance.

1.5.1.2 List A diseases

These are "transmissible diseases which have the potential for very serious and rapid spread, irrespective of national borders, that are of serious socio-economic or public health consequence and which are of major importance in the international trade of animals and animal products".

If these diseases are detected in a country, notification of the OIE by telegram, fax or e-mail **must occur within 24 hours**. Thereafter, weekly reports on the outbreak are required until the disease is eradicated, or is sufficiently stable for monthly reporting. Annual reports of List A and List B diseases and any other diseases considered to be of socio-economic importance or of major veterinary interest are also required by the OIE.

List A disease which may occur in horses are listed in Table 1.

1.5.1.3 List B diseases

These are "transmissible diseases that are considered to be of socio-economic and/or public health importance within countries and that are significant in the international trade of animals and animal products". Reports are normally submitted once a year, although more frequent reporting may in some cases be necessary.

List B diseases which may occur in horses are listed in Table 1.

1.5.2 Animal Health Trust

The Thoroughbred industry has its own international reporting system undertaken by the International Breeders Meeting, representing the major Thoroughbred breeding countries. The introduction of this reporting system was in response to outbreaks of contagious equine metritis (CEM) and equine viral arteritis (EVA)[119]. Quarterly disease reports are submitted to a collating centre at the Animal Health Trust, Newmarket, England, and distributed to 20 participating countries (including Australia). Over the years the system has provided evidence of the widespread distribution of strangles, equine herpesvirus-1 (EHV-1) abortion and equine influenza, as well as information on outbreaks of EVA, Hendra and West Nile virus infection.

1.5.3 Australia

There are a number of organisations within Australia that co-operate to provide disease (including exotic) surveillance for our country. The ***National Animal Health Information System (NAHIS)*** is co-ordinated by ***Animal Health Australia (AHA)***, a non-profit public company that brings together animal industry groups and Commonwealth, state and territory governments. This system acts to provide timely and accurate summary information on Australia's animal health status to support trade in animal commodities and meet Australia's international reporting obligations. It also provides information on Australia's capabilities and activities with regard to animal diseases surveillance and control. NAHIS has a quarterly newsletter called ***Animal Health Surveillance***, which provides updates on disease surveillance in all states of Australia as well as other activities of Animal Health Australia. The newsletter includes information on any outbreaks of horse diseases that have been investigated by the state ***Departments of Agriculture*** or ***Departments of Primary Industry*** during the previous quarter. This newsletter is available on the web at http://www.aahc.com.au/status/ahsquarterly/.

The Commonwealth Department of ***Agriculture, Fisheries Forestry ~ Australia (AFFA)*** has a number of remits including the ***Australian Quarantine and Inspection Service (AQIS)***. This service is discussed in greater detail in section 2 of this manual. "***Top Watch"*** is one program that is run by AQIS and has been part of the ***North Australian Quarantine Strategy (NAQS)*** for almost 10 years. As the name suggests, the focus of this program is on raising quarantine awareness in Northern Australia. The program encourages local communities, industry groups and visitors in northern Australia to report to quarantine officers unusual pests, disease occurrences and illegal landings by traditional fishing boats and cruising yachts. This program has a ***major role in surveillance against a number of exotic diseases of horses*** that are near our shores including Japanese encephalitis and surra.

Finally, the ***Australian Animal Health Laboratory (AAHL)*** is a national centre of excellence in disease diagnosis, research and policy advice on animal health in Australia. The laboratory is a major facility of CSIRO Livestock industries and is situated in Geelong, Victoria. This laboratory is one of the most sophisticated in the world for safe handling and containment of animal diseases. AAHL plays a vital role in maintaining Australia's capability to quickly diagnose exotic and emerging animal diseases. In addition to their role in diagnosis and study of important exotic and emerging diseases, AAHL plays a role in helping to assess the risk of introduction of exotic diseases and in disseminating information on these diseases. They have a number of excellent publications regarding exotic diseases of all livestock species, and which are available at their website.

1.6 How might an exotic diseases enter Australia?

Equine exotic diseases could be introduced to Australia in a number of different ways, and consequently we have quarantine regulations in place to minimise the risk of disease introduction by all these routes. Nonetheless, it is important for horse owners to be aware of the different ways that exotic diseases may enter Australia so they can help maintain vigilance against their introduction.

Infected horses are the most common method for introduction of equine exotic diseases. ***However, it is important to know that the horse does not have to be showing (clinical) signs of a disease to be potentially carrying the causative agent***. Horses can be subclinically infected with a disease agent – this means that they are carrying the disease-causing organism, but are not showing signs of disease. Horses can also become ***long-term carriers*** of certain disease agents and these horses often do not show clinical signs. An example of this is with stallions infected with ***equine viral arteritis***, in which the virus can continue to be excreted in semen for lengthy periods by an apparently healthy animal.

Other equine exotic diseases ***do not require a horse to be introduced*** to Australia**.** For example, the disease-producing organism may enter Australia within another animal or bird that either has the disease, or is simply carrying the organism. Some examples of diseases that can affect other animals include vesicular stomatitis (pigs), West Nile virus (birds) and rabies (all warm blooded animals).

Another possible means for an organism to enter Australia ***is through insects.*** There are a number of equine exotic diseases that are transmitted to horses by the bite of an insect. Insects carrying disease organisms may potentially be introduced to Australia within aeroplanes, on a boat, or be windborne (e.g. mosquitoes carrying Japanese encephalitis virus). Alternatively, they may be attached to a horse or another animal (e.g ticks carrying *Babesia equi).*

Many organisms can survive for a variable period of time outside their host animals and provides another way that they may be introduced to a new country. For example, some organisms can survive for a variable period of time ***within semen*** that is frozen or freshly chilled. If this semen is then transported internationally, the organism may be transmitted to mares in another country and provides a mechanism for the introduction of an exotic disease. Diseases that may be transmitted in this fashion include contagious equine metritis and equine viral arteritis. Alternatively, when an organism contaminates an inanimate object, the object is often called a ***fomite***, and these may be an important source of infection for a range of

exotic diseases. It is important to remember that ***your shoes, clothes and tack*** can be contaminated with disease agents, and that you can carry potentially dangerous organisms back into Australia if you have come into contact with horses or livestock whilst you are overseas.

Organisms causing exotic diseases may thus enter Australia via;

- ✓ infected horses (which may or may not show signs of disease),
- ✓ infected semen
- ✓ infected animals or birds,
- ✓ meat and animal products of infected animals (not only horses)
- ✓ infected insects
- ✓ soil from an affected farm,
- ✓ tack (e.g. saddles, bridles, brushes)
- ✓ shoes or clothing of people who have visited horse studs, horse events or farms.

Quarantine regulations are in place to minimise the risk of disease introduction. Even so all horse owners should carry out some simple procedures to provide further safeguards. These include monitoring any newly imported or introduced horse for the first few weeks after introduction for signs of diseases. Other horses on your property should also be monitored for signs of disease. If you are at all concerned about any of the exotic diseases you should immediately contact the appropriate authorities.

1.7 How could an exotic disease be spread in Australia?

An exotic disease could spread via a number of different ways once it was introduced to Australia. The ways that it would spread depends on the agent and how it is normally transmitted between horses, and also whether an insect vector is involved. The rapidity with which an exotic disease is spread will also depend on how infectious the agent is (how easily it is transmitted from one horse to the next), and how many horses that the infected horse comes into contact with.

The ***respiratory route of transmission*** is a very important route as it involves one of our most serious exotic diseases, equine influenza. This disease is highly contagious, and has the ability to spread rapidly in a naïve population. Organisms are usually transmitted via the respiratory route within aerosol droplets. When a horse coughs, these droplets may travel up to 35 metres, and the possibility exists for windborne spread of the droplets up to 8km[53]. On a number of occasions equine influenza has spread between a group of horses during shipment or quarantine. Consequently, it is important during quarantine to keep all animals together in an ***"all in – all out" policy***. This policy dictates that all the horses admitted to a quarantine station must enter and leave at the same time. Therefore disease producing organisms cannot be transferred from one animal newly arrived at the station, to another that is leaving.

Venereal transmission (spread at mating) is another important route of transmission and involves diseases such as contagious equine metritis, equine arteritis virus, and dourine. Transmission of these organisms may also involve transported semen, and the disease may be spread by contaminated semen with the use of fresh-cooled or frozen semen via artificial insemination. This route of transmission is an important consideration for those horse owners involved in the horse breeding industry.

Insects can potentially carry an exotic disease rapidly over large distances, and also make an exotic disease more difficult to eradicate. In addition, there a variety of insects (e.g. species of ticks, mosquitoes, and *Culicoides*) that are present throughout Australia, particularly in Northern Australia, which have an unknown potential for transmission of exotic diseases of horses. Insects may act as ***vectors*** of the disease-causing organism, in which case the organism must spend part of its life cycle within the insect, and may multiply to large numbers at this time. Diseases that are transmitted by insect vectors include babesiosis (ticks), viral encephalitides – WEE, EEE and VEE (mosquitoes) and African horse sickness (*Culicoides* spp). Alternatively, insects may act purely as ***mechanical hosts*** in that they transfer the organism from one animal to another, with no (or limited) multiplication of the organism. Diseases transmitted in this way include vesicular stomatitis and surra.

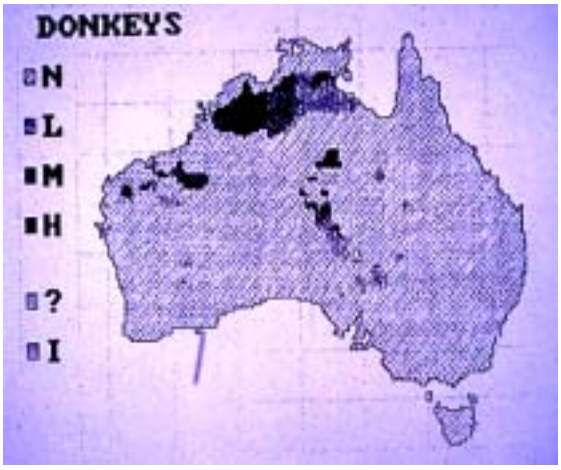
Ingestion is another route whereby horses may acquire infections. They may directly ingest the organism (e.g. glanders, *Salmonella abortus equi*) or the horse may eat a stage of the organism within faeces of other animals (e.g. opossum faeces containing the parasite that causes equine protozoal myeloencephalitis) or the organism may be in tissues of other animals (e.g. *Trichinella* spp in tissue cysts within pigs or rodents).

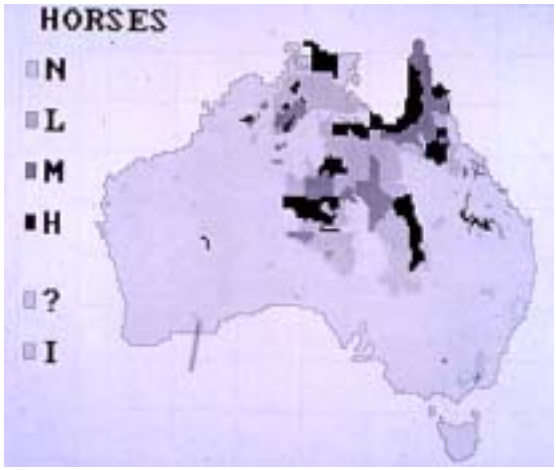
Contact with mucous membranes or the discharge from wounds is another way that some agents are transmitted from infected animals to non-infected animals. Examples of organisms that may be transmitted in this way include the vesicular stomatitis virus, *Trypansoma evansi* the causative agent of surra, *Burkholderia mallei* the causative agent of glanders, and *Histoplasma capsulatum* var *farciminosum* the causative agent of epizootic lymphangitis. It is therefore important, when these diseases are suspected, to prevent contact of body secretions (e.g. saliva, nasal discharges) and wound discharges with any other animals, particularly horses.

A number of exotic diseases are characterised by a ***carrier state*** and transmission may be via the carrier animal. In these cases, the carrier horse previously had the disease, but has recovered and now "carries" the organism within its body. Most carriers no longer exhibit clinical signs of disease, but disease may recrudesce if the animal is stressed or suffers from an alternate disease process. At this time, they may begin to shed the disease-causing organism once more, allowing transmission to in-contact animals. Alternatively, the carrier horse may continuously shed infective organisms. Diseases in which a carrier state may exist include contagious equine metritis, dourine, equine babesiosis and equine viral arteritis. It is very important to test and detect carriers during quarantine and this is why animals are tested for these diseases in pre-export quarantine prior to being imported into Australia.

Feral horses and ***donkeys*** are prevalent in Northern Australia, and parts of Eastern and Western Australia. If an exotic disease became established in these populations, it could spread very widely and could be very difficult to eradicate. This would be particularly true if an insect vector were involved in transmission. The infected feral animals could pose a potential threat to domestic horses, particularly those living near regions where populations of feral horses or donkeys are large. The approximate distribution of feral horses and donkeys are shown in **Figures 3and 4**.

Figures 3 and 4. Distribution of feral donkeys and horses in Australia





1.8 Have any equine exotic diseases been previously introduced to Australia?

There is historical evidence that a number of equine exotic diseases have been previously introduced to Australia (**Table 2**). Most of these diseases have been eradicated, such as contagious equine metritis (CEM), or not become established, such as *Babesia equi*. However, some of these diseases are still present in Australia such as equine infectious anaemia and equine viral arteritis (EVA). They provide an important reminder that exotic diseases can be introduced on occasions and some may have significant economic consequences for the equine industry, such as CEM. Others such as EVA have had minimal consequences.

Table 1.2: Horse diseases that have been introduced to Australia

DISEASE/AGENT	ENTRY/DISCOVERY	ERADICATION
Glanders	1891 (in quarantine)	Yes
Surra	1907 (in quarantine)	Yes
Equine Infectious Anaemia	1950	No
Babesia equi	1976	Yes
Equine Herpesvirus-1 abortion	1977	No
Contagious Equine Metritis	1977	Yes
Equine Arteritis Virus	Pre-1975?	No
Japanese Encephalitis	1998 (mainland)	Yes (mainland Australia)

1.8.1 Outbreaks of equine exotic diseases

There have been a number of outbreaks of equine exotic diseases both in Australia and world wide. These outbreaks help remind us of the serious consequences that introduction of these diseases can have.

1.8.1.1 Australia

One of the most significant outbreaks of an equine exotic disease in Australia was the 1977 incursion of ***contagious equine metritis (CEM).*** This disease was first recorded in Thoroughbred horses in Newmarket, England in May 1977[116], and was subsequently diagnosed in Ireland, continental Europe, the United States and Australia. At this time the disease caused global disruption to the Thoroughbred breeding industry. The disease was first identified in Australia on a thoroughbred stud in Victoria in late August 1977, but may have been introduced in 1976[56]. The last Australian case was recorded in 1980 and ongoing surveillance has not revealed any further cases since that time. Australia was officially declared CEM-free in 1985[42].

Estimates of some of the **costs of the outbreak** of CEM in Australia in the period between 1977 and 1983 have been made and included:

- ✓ $1 million Routine mare swabbing
- ✓ $12 million Export losses
- ✓ $500 Export testing per mare
- ✓ $250,00 - $500,000 Cost per infected stud

1.8.1.2 Overseas

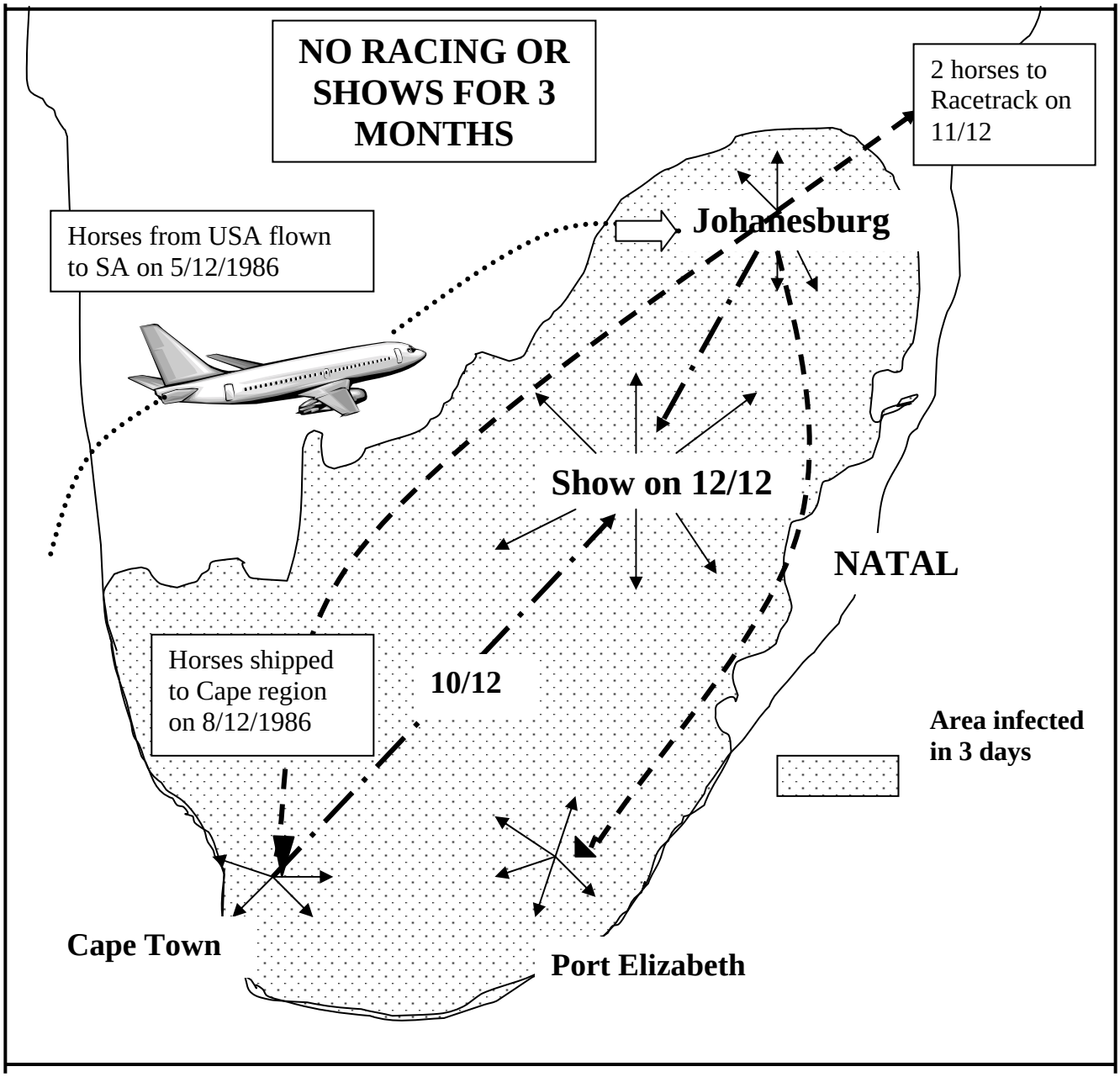
There have also been a number of notable examples of outbreaks of equine exotic diseases overseas, and they provide important illustrations of what might occur in Australia were an exotic disease introduced. Although the most serious and devastating epidemics have been caused by African horse sickness and Venuzuelan equine encephalitis viruses, the most common disease associated with large outbreaks in horses is equine influenza[149].

An example of the economic consequences of an outbreak of an equine exotic disease was the introduction of equine influenza into Hong Kong in 1992, which resulted in the cancellation of 7 race meetings over a period of 32 days, and the loss of close to a billion dollars in revenue[120]. In this outbreak, vaccination did not prevent 75% of the horse population in Hong Kong from becoming infected, and half the infected horses developing clinical signs. However, vaccination did contribute to a reduction in severity and duration of clinical signs.

Another example of an outbreak of an equine exotic disease occurred when equine influenza was introduced to South Africa in 1986 following importation of six horses from the United States[49]. The absence of an "all-in/all-out" quarantine policy at this time in South Africa contributed to a breakdown in quarantine. The outbreak began when in-contact horses were released from quarantine three days after arrival of the six horses from the USA. These horses were subsequently transported to different areas of the country, providing rapid and widespread dissemination of the disease. Further spread of the disease was associated with introduction of the virus by personnel or contaminated instruments[49]. **Figure 5** illustrates the rapidity with which this outbreak spread and the large area affected within three days of release from quarantine of the infected horses. One of the consequences of this outbreak was

the cancellation all horse events (including races and shows) for three months. In addition, due to the susceptibility of the equine population, significant mortality of horses was recorded, particularly of young animals[49]. Control of the disease was assisted by vaccination, which has continued in South Africa until the present day and adds to the economic costs of horse ownership.

Figure 5: Spread of equine influenza in South Africa during the 1986 outbreak.



2. How do we stop exotic diseases from entering Australia?

Australia has a unique position in the horse world in that we do not have many of the serious diseases that affect this species. There are a number of reasons for this absence of disease and these include our remoteness, the fact that we do not have native horses, the relatively short incubation period of most of the serious exotic diseases (so horses that were shipped to Australia in our early history either died or got better before they arrived in Australia!) and most of all our strict, but fair, ***quarantine regulations***. These regulations have ensured our continued freedom from many exotic diseases of horses, even in this era of increasing globalisation of the horse industry and frequent transportation of horses around the world.

The ***Australian Quarantine and Inspection Service (AQIS)*** is an operating group within the Department of ***Agriculture, Fisheries and Forestry, Australia (AFFA)***. Their primary role is to contribute to, and administer, Australia's quarantine, agriculture and food export regulations. AQIS is responsible for administration of the Quarantine Act of 1908 and its related legislation. The act provides powers for quarantine officers to deal with quarantine matters, sets out the legal basis for controlling the importation of goods, animals and plants, and determines the penalties for breaches of the Act. AQIS provides quarantine and inspection services for the arrival of international passengers, cargo, mail, animals and plants or their products into Australia. It also has inspection and certification for a range of animal and plant products exported from Australia. However, we must remember that ***quarantine is shared responsibility of the government, industry, and the Australian public***.

Everyone in the horse industry must help our quarantine services to stop exotic diseases from entering the country. To this end we need to:

1. Follow quarantine regulations when returning home from overseas
2. Follow appropriate quarantine protocols when importing (and exporting) horses

2.1 Returning home

When returning to Australia from travelling overseas, it is important to complete the ***arrival declaration forms*** responsibly (ie. carefully and honestly) and ***to declare any horse-related items*** such as clothing, tack, feed, feed additives, equipment or medicines. These will be assessed for the potential to carry exotic diseases, and will be either allowed immediate entry to Australia, have to undergo decontamination procedures, or may, in the rare instance, be confiscated as they pose too great a threat for introduction of an exotic disease. The best people to know about these risks are the AQIS officers who are present at the airports and who will inspect your luggage.

Anyone failing to declare items they bring into the country is putting not just the horse industry at risk, but also our native animals, plants, and other agricultural industries!!! They also face penalties or fines for making false declarations on arrival forms. Anyone convicted of deliberately importing unauthorised animal material into Australia can face a jail term and fines of up to $100, 000.

2.2 Quarantine protocols for importation of horses

Australia has ***stringent quarantine requirements for the importation of horses***, and these will continue to be our first line of defence against the introduction of exotic diseases. If you are importing a horse you should follow the import procedures conscientiously. It is important to remember that these procedures are implemented to reduce the risk of exotic diseases entering Australia. Consequently it is essential to strictly adhere to these protocols if you are importing a horse.

Quarantine protocols will vary depending on whether the animal is to be brought to Australia ***temporarily*** (usually for competition or breeding purposes), or ***permanently***. They also vary depending on the country in which the horse normally resides, which is naturally dictated by the equine diseases present in these countries. Quarantine protocols are in place for horses from some 26 "approved" countries including the USA, Canada, the European Union, New Zealand, Fiji, New Caledonia, Norway, Norfolk Island, Switzerland, Singapore, Hong Kong and Japan. There are also special conditions for competition horses and horses returning to Australia after competition from some other countries, notably the United Arab Emirates, Singapore, Hong Kong and Japan. Australia does not have quarantine protocols in place for some other countries, and currently horses cannot be imported directly from these countries. In these cases, horses normally resident in countries not approved by AQIS for direct importation are required to ***complete a residency period of 60 days in an approved country before they are allowed entry into Australia***.

A number of different requirements may be implemented when horses are imported to Australia from countries with diseases that are exotic to this country. These requirements are put in place to reduce the risk of transmission of the causative agents to Australian horses. They may include vaccination against certain diseases, serological testing where justifiable, or attempts to isolate and identify the pathogen in question if necessary. These requirements may vary depending on the disease status of the exporting country. For example, the use of approved testing procedures for diseases such as equine viral arteritis, equine infectious anaemia, babesiosis (piroplasmosis), and contagious equine metritits is necessary for many countries of origin. These testing requirements are outlined by the Manual of Standards for Diagnostic Tests and Vaccines of the OIE and may be found at their website.

Before importation of a horse can occur, a valid ***permit to import*** must be obtained by application to AQIS. Conditions for importation of horses from various countries are available at http://www.aqis.gov.au/icon/asp/ex_querycontent.asp. These conditions include a declaration of freedom by a country, region or property from diseases that are not present within Australia. To this end, each horse must be accompanied by an ***Animal Health Certificate*** that is signed by an official veterinarian. The Animal Health certificate must conform to requirements of the OIE and incorrect certification may result in return of the horse to the country of origin at the importer's expense.

All horses entering the country, whether for the Olympic Games, the Melbourne Cup or because they are a beloved pet of a person emigrating to Australia, must go through routine quarantine. In general, there are 2 phases of quarantine; ***Pre-Export Quarantine (PEQ) and Post Arrival Quarantine (PAQ)***. Furthermore, pregnant mares that are permitted entry are held under quarantine surveillance following release from quarantine until 20 days after foaling. This surveillance may be extended at the discretion of AQIS, and any abortions or perinatal mortality must be investigated to AQIS satisfaction.

2.2.1 Pre-export quarantine (PEQ)

This phase is very important as it is during this time that detection of disease generally occurs if a horse is infected. Currently, horses can only be imported from an approved country (one that is free from serious exotic diseases such as African horse sickness, dourine and glanders) and the horses must have resided in this approved country for at least 2 months. ***In addition, the horse must reside in pre-export quarantine in approved premises for a minimum of 21 days for horses imported permanently and 14 days for horses imported temporarily.*** During this time there must be official certification of country, premise's and horse's freedom from specific diseases (e.g.equine infectious anaemia, equine influenza). Vaccination for diseases such as equine influenza and, in the case of horses imported from the USA, eastern and western encephalomyelitis, must have been conducted using approved vaccination schedules. Testing of horses for diseases such as equine infectious anaemia (Coggins test), and vesicular stomatitis must be demonstrated with negative results required. Competition horses (temporary imports) must subsequently travel to Australia accompanied by a passport containing records of their vaccination histories and international movements.

Prior to or during pre-export quarantine a number of procedures for the reduction or elimination of exotic organisms may be implemented. Horses are examined for the presence of external parasites and for signs of infectious diseases by a certifying veterinarian prior to entry into pre-export quarantine, and again prior to shipment. Horses must be found by the veterinarian to be free from infectious or contagious diseases and external parasites, and fit to travel. In addition, during this time they are treated for internal and external parasites.

Horses may only travel to Australia by an approved route. The compartment of the aircraft housing horses is disinfected and the plane is disinsected (insects killed by insecticide) prior to landing in Australia.

2.2.2 Post arrival quarantine (PAQ)

After arrival in Australia, horses must undergo a further 14 days of post arrival quarantine in an approved quarantine station. There are currently three approved quarantine stations in which horses are maintained after their arrival in Australia. These stations include Eastern Creek in Sydney and Spotswood in Melbourne, which are operated by government agencies, and a private facility established at Sandown in Victoria. In addition, occasionally horses imported for specific events may be housed in areas that are not routine quarantine stations. For example, the Sydney International Equestrian Centre (SIEC), which was the venue for the Sydney Olympic Games equestrian events, was also used as a quarantine station before the start of the Games. Most of the 256 horses competing at the Sydney Games spent 14 days of quarantine at the SIEC after their arrival in Australia. The SIEC provided facilities for show-jumping, dressage and three-day event training so that horses could stay in "work" during the quarantine period. Similarly, horses housed at the private quarantine centre in Sandown may continue to stay in race training during the quarantine period.

During the PAQ, horses are monitored for disease and any disease occurrence is fully investigated, and exotic diseases ruled out. Blood samples and tissue specimens are sent to approved laboratories (predominantly AAHL) for testing if an exotic disease is suspected. All waste products are appropriately disposed of during the quarantine period. Once horses are released from the Quarantine stations, and if they are staying in Australia on a temporary basis, they are kept under quarantine surveillance until exported.

3. What should you do if you suspect an exotic disease?

It is important to remember that we all have a role to play in the vigilance against exotic or emerging diseases. ***The people that are handling horses on a daily basis are the ones that are most likely to first detect a sick horse or group of horses***. There are a number of clues that may help you to identify a horse with an exotic disease, and which are discussed in this section. If you have any suspicions at all that your horse, or a horse that you are looking after, has an exotic disease you should immediately contact your local veterinarian – remember to "look, check and ask a vet…" If there is any likelihood that the disease involved is an exotic disease, then there is in place legislation that must be followed in order to correctly diagnose the disease, and instigate eradication procedures. These regulations are clearly and comprehensively covered in the AUSVETPLANS, which are discussed later in this section.

3.1 How do you identify an exotic disease?

In the event of an exotic disease occurring in Australia, it is **very** important to identify the disease ***as early as possible***. In this way the exotic disease may be stopped from spreading, and there is a good chance of being able to eradicate it quickly.

There are a number of things that every person who comes into contact with horses, on a daily or less frequent basis, can do to help identify an exotic disease.

3.1.1 Be alert

- ***Watch carefully*** for any sign of illness, especially in ***newly imported horses***. The sort of signs to look out for:
  - ✓ going off food (inappetence, anorexia)
  - ✓ high temperature (fever)
  - ✓ runny nose (serous or purulent nasal discharge)
  - ✓ coughing (particularly if hacking)
  - ✓ rapid or laboured breathing
  - ✓ change in behaviour

- ✓ discharge from vulva
- ✓ abortion
- ✓ swellings
- ✓ death

- ***A simple way to monitor any newly arrived horse*** to your property is to perform a thorough physical examination of the horse and to take its temperature on a daily basis. This should be continued for 1 to 2 weeks after their arrival. If the horse's temperature is greater than 39°C then the horse should be closely watched for any other signs of disease, and a veterinarian consulted if the fever (pyrexia) continues.

- These, and the other signs listed above, are particularly important if ***any*** other horse that comes in contact with an imported horse ***also starts showing the same signs*** ie. an **OUTBREAK** of disease has occurred.

- In addition, a more thorough list of the clinical signs associated with individual diseases are outlined in section 5 of this manual, and which you can use to familiarise yourself with the potential signs you may observe.

3.2 Contact appropriate authorities immediately

If you have **ANY** doubts about a possible exotic disease you should **IMMEDIATELY** contact your ***local veterinarian***, who will be able to advise you what to do. If, by some chance you are not able to contact your local veterinarian, you should call the local ***Department of Agriculture*** or ***Stock Inspector***. It is important to keep on trying until you reach someone. ***Leaving a message is not adequate.*** If neither your local veterinarian or government veterinarian are contactable, an ***Emergency Disease Hotline*** is available for information regarding exotic diseases. This free phone number and is open 24 hours a day, 7 days a week, and you will be able to discuss your particular case with someone.

You should keep the number of your local veterinarian, the government veterinarian and the emergency hotline near your phone so that you have it available when you need it.

If you do not have a phone on your property, you should disinfect yourself (see later for advice on disinfectants) as thoroughly as possible and travel to the nearest telephone that is not on a farm or property that has susceptible horses.

3.3 Isolate horses suspected of having an exotic disease

It is preferable that you always isolate any newly arrived horse when it is first introduced to your property. Isolation helps prevent the introduction of any contagious disease, exotic or otherwise, to your property. However, if you have not done this as part of your routine, and if you suspect an exotic disease, you should implement isolation of the suspected horse(s) while you are waiting for a response from the appropriate authorities. There are a number of general rules for isolation of horses suspected of having an exotic disease, and many of these rules also applying to any horse suspected of having a contagious infectious disease. These rules will need to be implemented until the exotic disease is either confirmed or ruled out by the appropriate authorities.

3.3.1 Distance

A good rule to follow with respect to how far to isolate a horse with a suspected exotic disease is that is should be placed ***"as far away as possible from all other horses on your property!"*** This will of course vary between properties, but you **MUST** at the very least not have the horse in contact (especially nose-to-nose contact) with other horses. The greater the distance from other horses, the less likely the organism will be able to be transmitted to other horses, ***especially by aerosol.*** A distance of 100m is frequently recommended for an isolation

distance. Evidently, however, consideration for where to place the horse with a suspected exotic disease will also be influenced by the nursing requirements of a sick horse.

3.3.2 Equipment

You should also remember that anything coming into contact with an infected horse may become contaminated with the infectious agent. Consequently, you must **NEVER** use the same equipment on other horses on your property that you have used on the horse with the suspected exotic disease. For example, do not lead the horse to an isolation paddock, and then use the same halter on another horse. Similarly, any feed bins, buckets, brushes, rugs, bridles, saddles, saddle cloths etc, must not be shared. Finally, don't forget that your boots, clothes and hands may have come in contact with the infectious organism and it is preferable, if at all possible, that you do not come into contact with any other horses on the property, or other properties. If this is not possible, due to welfare considerations, you should change your clothes and boots and carefully wash your hands (for at least 5 minutes) in disinfectant before you touch another horse.

3.3.3 Insects

A number of exotic diseases are spread by insects, particularly biting flies, mosquitoes, ticks and *Culicoides* spp (midges). If one of these insects bites a horse infected with an exotic disease, the insect may also become infected with the agent, and be able to transmit the organism to another horse. In this way the organism may become established in this country. If this occurs, the exotic disease would be much more difficult to eradicate. While it is very difficult to completely stop access of insects to a horse with a suspected exotic disease, it is a good idea to keep the horse in a stable, as this will stop midges from biting. In addition, insect proofing the stable with mesh to stop mosquitoes and biting flies may be of value. Horses should be kept away from large bodies of water (e.g. dams), as these attract many insects such as mosquitoes and *Culicoides* spp, and any ticks should be immediately removed and kept for identification.

3.4 Stop all movement onto or off the property

If you suspect an exotic disease, until you get help you should not allow any new stock onto the property and stock should not be allowed to move off the property. This includes any horses, as well as other animals such as pigs, cattle, sheep, dogs, and cats. Remember that some of the exotic disease of horses may be transmitted by other species, and for this reason they should not be allowed off the property.

It is also preferable if you do not travel off the property until appropriate authorities have been contacted and they have told you what plan you should follow. Humans may also carry the exotic disease, particularly on their clothes, boots or hands, if they have come into direct contact with an infected horse. In particular, it is important that if you must leave the property ***you should not come into contact with any other horses on a different property*** if you have any suspicions of an equine exotic disease. You should also discourage unauthorised people from coming onto your property and especially having contact with the horse with a suspected exotic disease.

3.5 Decontamination and disinfectants

In the event of an incursion of an exotic disease, there are very strict protocols that must be followed in order for it to be rapidly eradicated. These protocols are discussed further in the section under AUSVETPLANS. These plans take into consideration extensive procedures for decontamination of anything that may have come into contact with the foreign organism.

Decontamination is the combination of physical and chemical processes that kills or removes pathogenic micro-organisms and is vital for disease eradication[7]. Thorough decontamination will involve ***close co-operation*** between the horse owner, property owner, and all personnel involved in cleaning and disinfection procedures. In general these personnel will be appointed by the Department of Agriculture, and they will know what is required for appropriate decontamination of your property.

The identification of the disease agent (virus, bacteria or parasite) is essential for designing an appropriate decontamination strategy. However, this may take a while to do, and will involve appropriate samples being collected and being sent to an approved laboratory (e.g. AAHL) for testing. In the meantime, there are a number of simple things that you can do to help prevent the spread of the exotic disease. Importance should be placed on isolation of the source of infection (e.g infected horse), decontamination of personnel, equipment, vehicles and sites that this horse may have come in contact with, and prevention of movement of people and animals onto the property. General rules for isolation were discussed in the previous section. Some general rules for disinfection include:

- The presence of ***organic material*** such as faeces, dirt, feed, straw or sawdust, will stop most disinfectants from working properly. Consequently, if a stable is to be decontaminated, it needs to be firstly cleaned of these materials. Obviously, if the stable has a dirt floor (as opposed to a concrete floor), this procedure will be more difficult, but it should still be cleaned as thoroughly as possible. The faeces, straw, sawdust, feed etc should be disposed of in an appropriate fashion, as they may contain the exotic disease agent. Your local veterinarian or Department of Agriculture inspector will assist you with this.

- If the horse with the suspected exotic disease has been ***transported (in a float or truck***) recently, this will also require decontamination. Similar to the stable, it must first be cleaned of all dirt, faeces and organic matter before the use of a disinfectant. If a transportation company has been used to move a horses with a suspected exotic disease, they must be informed as soon as practical, usually on the advice of your local veterinarian or Department of Agriculture officer.

- A simple but effective disinfectant that is active against many of the agents causing equine exotic diseases is ***bleach*** (hypochlorites). However, it should be remembered that hypochlorite solutions rapidly lose strength upon storage, and only freshly made-up solutions should be used for disinfection. They should be used at the concentrations recommended on the label. In addition, their action is markedly reduced in the presence of organic matter. Consequently, a good idea is to clean an area or piece of equipment with ***soaps or detergents*** first, to get rid of most of the organic material, and then follow up with bleach for decontamination.

- If a horse has been kept in a paddock or yard, the yard should be carefully cleaned of all manure and any discharges (which should be disposed of correctly), and then left vacant for a period of time. This may vary (depending on the organism that is suspected), but a minimum of 2 to 4 weeks will be required. In addition, ***most of the disease causing agents do not survive in hot dry conditions***. So if the outbreak occurs in summer, this is better as it will shorten the survival time for the agent (as opposed to cool, wet conditions). You should discuss the period of time required for isolation of the paddock or yard with your veterinarian or Department of Agriculture inspector.

3.6 AusVetPlans

In general, it is Australian policy to eradicate, if at all feasible, any serious exotic disease of animals as expeditiously as possible. An effective response to an exotic or emergency disease outbreak requires planning at a national, state/territory and district level. It involves both animal health authorities and emergency management organisations. The basis for this planning is contained within the AUSVETPLAN (Australian Veterinary Emergency Plan).

Each AUSVETPLAN describes the proposed Australian approach to the introduction of a specific exotic disease. There are currently 25 Disease strategy plans, including several for horse diseases. The AUSVETPLANs that are currently available can be found at http://www.aahc.com.au/ausvetplan/. The plans which involve equine diseases include:

- ✓ African Horse Sickness
- ✓ Japanese Encephalitis
- ✓ Equine Influenza
- ✓ Rabies
- ✓ Vesicular Stomatitis.

Manuals that will be available soon include:

- ✓ Contagious Equine Metritis
- ✓ Surra.

In addition, there are 6 manuals on **operational procedures** (including decontamination and wild animal management) and 10 manuals on **enterprises** (including animal quarantine stations, saleyard and transport, and veterinary practices).

These plans remain the mainstay for our response to any incursion of an exotic disease, whether in a horse or any other species.

4. Viewpoints

Protect Australian livestock campaign

"Protect Australian Livestock Campaign" is organised by ***Animal Health Australia***, which is a non-profit public company that brings together animal industry groups and Commonwealth, state and territory governments. One of the remits of this company is to raise awareness about emergency animal diseases that affect all our livestock species and to help ensure our preparedness in case of a disease incursion.

Emergency animal diseases are those diseases that are either brought in from other countries (exotic diseases) or are new diseases, which have originated from within Australia. An emergency animal disease may also be a disease that we have here already (an endemic disease) but for some reason the diseases has become out of control or has become more severe. Emergency animal diseases affect our livestock industries, including those involving horses, cattle, sheep, poultry, pigs, deer, alpacas, goats and emus. Emergency animal diseases include African horse sickness, equine influenza, foot-and-mouth disease, Newcastle disease, Hendra virus, rabies, screw-worm fly, bovine spongiform encephalopathy (BSE), African swine fever, and avian influenza. There are more than 50 known diseases which pose a realistic risk to Australian Livestock.

One of the highlights of the campaign is the annual ***Protect Australian Livestock Week***. The focus of this week is to remind all livestock owners and producers to be constantly aware of the threat of emergency animal diseases to Australia's valuable livestock industries, including our horse industry. This annual event helps to ensure that this important issue is at the forefront of producer's minds and to reinforce the fact that Australians cannot afford to become complacent about emergency animal diseases.

Within the Protect Australian Livestock Campaign a number of resources are used to communicate this important message to our livestock industries. For example TV commercials, community service announcements, and video news releases are distributed to regional TV stations. Rural and regional newspapers, television and radio stations are encouraged to run stories and photographs about the campaign. Information is also disseminated through brochures and posters direct to producers with the support of more than 200 advocates and livestock industry organisations across Australia. Finally, livestock (including horse) industry representatives are interviewed about this issue and these interviews are posted on a special web-site (http://www.aahc.com.au/palc/). Interviews obtained for the 2001 Protect Australian Livestock Week with three representatives of the horses industry have been included in this manual with kind permission by Animal Health Australia, and the Emergency Animal Disease Preparedness Group. These interviews help to highlight a number of issues regarding exotic, and other emergency, horse diseases and provide a perspective of people working in the horse industry.

Riding on the European circuit not so carefree when horse disease is widespread

Olympic equestrian gold medallist Stuart Tinney says life for horse people in Australia is blissfully uncomplicated, compared with Europe. When he first set off with his gelding Bright Beacon as a short-listed Barcelona hopeful, he saw first-hand the drawbacks of living and competing in countries where horse disease is rife.

In France where the Olympic selection trials were held in 1992, he found that unless horses were immunised every year against the highly infectious disease, equine influenza, they were not permitted to compete.

"It is only when you take horses overseas, that you realise how disease free we are," Stuart said. "People should be aware how lucky we are."

Stuart is helping to remind animal handlers and livestock producers of the importance of keeping emergency animal diseases out of Australia as an advocate for **Protect Australian Livestock Week**. The week highlights the need to constantly be aware of disease threats, and urges livestock owners to **"Look, check and ask a vet"** if any unusual disease symptoms are noticed.

In 1998, as part of the training squad for Sydney, Stuart competed at the World Championships in Europe and joined the eventing circuit in the UK, Italy and Holland.

At the renowned Badminton three-day-event in the UK on his horse Tex, regarded as one of the top event horses in the world, he had an experience his colleagues still tease him about. In shockingly muddy conditions, soaked by pouring rain, Stuart lost his grip on the slippery saddle and reins and Tex took an unconventional route over a barrier into the crowd. The resulting photographs were published in newspapers and magazines all over the world.

This notoriety apart, Stuart still managed to impress Sydney Olympics selectors, go on to take team gold and be a part of Australia's equine history with three Olympic eventing wins in a row. Other team members were Andrew Hoy, Phillip Dutton and Matt Ryan.

Born in central Queensland, Stuart lives with his wife Karen and two young daughters, on 12.5 ha just outside Sydney where he rides professionally, trains horses for clients and coaches students. Karen helps with pre-training and exercising the 25 horses in their care, which of course include Olympic horse Jeepster.

Stuart said we are very lucky in Australia to have such a disease-free environment. Nevertheless, riders still had to prove the clean health of their horses before they left for overseas.

Horses needed to be fully immunised for equine influenza and have no nose-to-nose contact for 30 days prior to departure. They also needed to have blood tests before and after arrival. If all was well, they were then free to travel and compete.

"Coming back to Australia is a different story though," said Stuart. "In Europe, horses are quarantined for four weeks before leaving, then quarantined again in Australia for another two weeks."

To ensure Australia stays disease free, Stuart urges people to respect the natural barrier our geography provides. "Stick to the law," he says. "Don't bring anything into the country that you shouldn't. Don't walk in with soil on your shoes. Keep our country disease free."

Racehorse mobility can spread 'terrifying' diseases

An exotic equine disease finding a host in Australian wild animals and biting insects could produce a catastrophe, not only for the racing industry but also the wider horse community, according to leading Brisbane trainer, Pat Duff.

"The diseases that most terrify horse owners are equine influenza and African horse sickness, which have not yet appeared in Australia. We already have strangles that can cause more complicated lung and other problems and finish a horse's racing career," Mr Duff said. "What concerns me in particular is that if a disease got into the Gulf Country, it could be easily transmitted by mosquitoes, brumbies, pigs and flying foxes, then to just one horse taken to a regional meeting. It would not take long for it to be transmitted to a Brisbane stable and then through the wider racing community."

Mr Duff, who has held a trainer's licence for 35 years, started his training career in the Burnett area and moved to Brisbane while still in his 20s. He runs a stable of 35 horses in work, with about 20 horses spelling, and is consistently one of the top 20 trainers in the State. In 1991, he completed the year second on the Brisbane Trainer's Premiership table.

His horses race mainly in the Brisbane area, but travel as far north as Cairns and west to Dalby, with occasional trips interstate.

The extreme mobility of horses around the racing industry has the potential to rapidly spread disease until it is impossible to control, a concern that has prompted Mr Duff to introduce quarantine procedures into his own stable.

Mr Duff said that within this quarantine system, which is designed to detect contagious illness such as strangles and influenza, the horses are kept away from others in the stable and staff disinfect before and after contact with the horses and during activities such as mixing feeds. Horses from Mr Duff's stable that are transported to and from race meetings are monitored for symptoms, including having their temperatures taken regularly as an early indicator.

Mr Duff urged other trainers and owners to be as vigilant as part of **Protect Australian Livestock Week,** which highlights the threat of emergency animal diseases. The campaign urges them to **"Look, check and ask a vet"** and report all unusual symptoms without delay. **Protect Australian Livestock Week urges livestock owners to report unusual disease symptoms immediately to a veterinarian, stock inspector, or the Emergency Disease Watch Hotline on 1800 675 888.**

Look, check, ask a vet....

While Australia's relatively sparse population of animals will protect the country to some extent from an outbreak of exotic disease, constant vigilance by owners will ensure any outbreak is easily contained, according to Victorian veterinarian and eventer/showjumper, Nick Roe.

Dr Roe is a lecturer at Marcus Oldham Agricultural College at Geelong and has five competition showjumpers and eventers in work. He said that while there were a wide variety of exotic diseases that posed a serious threat to horses, there were two in particular that could cause serious emotional and economic damage to the horse industry if they entered Australia. "The first is equine influenza which is like human influenza in that it is very contagious, although it is unlikely to actually kill the horse. It is a high morbidity, low mortality virus, where not many horses actually die," he said. "This virus can be rapidly spread by expired air and by close direct contact, so it can disable entire stables for weeks at a time. It can have a severe economic impact if races are abandoned. It also takes time for a horse to recover, reducing the horse's earning potential. "The equine influenza virus can retain infectivity in the environment for up to 36 hours. Therefore, infection can be spread by contaminated horse floats or similar. "This virus is a major concern in the racing industry - in South Africa racing was shut down for three weeks because just about every horse in work had the virus."

Dr Roe said another worrying exotic disease was the much more serious African Horse Sickness, a deadly virus that is not directly contagious between horses but is spread through an insect. "Most horses that contract this virus die. They get an initial fever of 40°C or higher, they don't feel well or look well and because it's mainly a respiratory disease, they have frothiness and copious discharge from the nose. They develop a really bad cough, respiratory distress and die within 4-24 hours."

Dr Roe, who competes in NSW, Victoria and South Australia, said he was very conscious of infectious illness among his animals while travelling, and advised horse owners to establish a strict regimen designed to nip any virus in the bud.
"Every owner should be checking their horse daily for disease, and more often if the horse is in contact with strange horses. If they find anything, whether it's by checking over the horse visually or by taking its temperature, they should check for other symptoms and consult a vet. "This is central to the message of **Protect Australian Livestock Week**, and the 'Look, Check, ask a Vet' concept should be part of the daily routine of all riders, owners and grooms," he said.

Protect Australian Livestock Week is held to encourages anyone involved with livestock to constantly be aware of the threat of emergency animal diseases. The campaign urges them to **"Look, check and ask a vet"** and report all unusual symptoms without delay. Dr Roe said that these precautions, combined with Australia's relatively sparse animal population, would help contain any outbreak of exotic and everyday diseases and viruses. "We don't have the highly concentrated populations of animals that other countries do, so it is easier to shut down the industry and control the virus than in other countries where the populations are much more dense," he said.

5. The diseases – a summary

The important exotic diseases of Australian horses are summarised in this section. The first table is a guide for the following tables as it outlines the different categories of information included for each exotic disease, and tells you why this information is important for the horse owner to know. Each of the major equine exotic diseases has a table that includes this information. In addition, special considerations, key features and photographs have been included for major equine exotic diseases. At the end of this chapter is a short discussion of additional diseases of less significance, or likelihood of entry into Australia. In addition some diseases in which we already have the agent, but not the strains causing disease, have been included.

	WHAT THIS CATEGORY WILL TELL YOU	**WHY IS IT IMPORTANT**
NAME	The veterinary name of the disease. For each disease the references from which the information was obtained are included.	The **references** [in superscript] are included if you wish to find out more about the disease.
CAUSE	The organism that causes the disease, e.g. a virus or a bacteria or a protozoa (parasite).	The cause will influence **how the disease is treated and controlled**.
HOSTS	The different species of animal that can become infected. The list always includes horses, but may include other animals e.g. pigs, humans.	This information is important as it will tell you **which animals can become infected** if the disease is introduced to Australia.
WHERE	Where the disease is currently found in the world.	This information is important to know, especially if your are **importing a horse** from that country.
IN AUSTRALIA	Whether the disease has ever been reported in Australia.	It shows that in some cases the disease can be brought to Australia.
SPREAD	How the organism spreads (is transmitted) between animals including horses.	This information is important when considering how the disease may **spread around Australia**. It will also influence how difficult it may be to eradicate the disease.
INCUBATION PERIOD	This indicates the length of time between the animals becoming infected and showing signs of disease.	This information will influence the **length of time** required for **quarantine.**
CLINICAL SIGNS	The signs that infected horses will demonstrate.	**If you see these signs, especially in a newly imported horse, you should CALL A VET.**
DIFFERENTIAL DIAGNOSIS	These are diseases that show the same (clinical) signs in horses, as the exotic disease.	When we suspect that a horse has one of these diseases, we also need to suspect the exotic disease. Some of the differential diagnoses are also exotic and they will be denoted with an asterisk (*).
DIAGNOSIS	Indicates the samples and tests required to make a diagnosis.	Your veterinarian may **collect these samples to diagnose** the disease
COSTS	Indicates the possible economic cost(s) to the equine industry.	
ERADICATION	Indicates the likely ability to eradicate the exotic disease from Australia.	

5.1 Equine influenza[42,54,95,146,163]

Special considerations:

KEY SIGNS: many coughing horses with rapid spread

- This disease is the **major threat** for entry into Australia, as it is **highly contagious** and has a **short incubation period**.
- It is the disease that influences many of our quarantine protocols.
- The disease occurs in many of our major trading partners (UK, Europe, United States, Canada), but outbreaks are relatively infrequent due to widespread vaccination.
- Serious outbreaks occur if there is a change in the strain of virus (antigenic shift or drift) or if the virus is introduced to a country free of disease[49, 104,120].
- Partially immune horses (for example horses that have been vaccinated) may show no clinical signs (subclinical infection) but they may transmit the virus[102].
- The virus has caused most of the serious outbreaks of equine exotic diseases worldwide and can be rapidly spread by movement of infected horses to and from sales, shows, events and meetings. We can learn lessons from outbreaks in Hong Kong and South Africa, especially regarding spread (see section 1 "Have any equine exotic diseases been previously introduced to Australia?").
- An AUSVETPLAN for equine influenza has been produced and is available at http://www.aahc.com.au/ausvetplan/.

Figure 5.1: Confirmation of a diagnosis of equine influenza requires collection of a nasopharyngeal swab.

CATEGORY	WHAT?	IMPORTANCE?
CAUSE	▪ a **virus** - genus ***Myxovirus*** ▪ 2 equine subtypes – type A Equine 1, and type A Equine 2 ▪ all recent outbreaks were type 2 ▪ **strains** of type 2 exist	▪ **no cross immunity** between subtypes or strains ▪ this is very important for **vaccine development** and **control**
HOSTS	▪ mostly horses, but also other equidae, eg. donkeys, zebra ▪ disease is severe in donkeys	▪ other hosts or wild horses may act as **reservoirs** ▪ **human** can carry EI virus for up to 3 days in nasal cavity
WHERE	▪ most countries where there are horses ▪ Australia and N.Z. are free	▪ **many** countries have equine influenza, including countries from which horses are frequently imported
IN AUST.	▪ **never** reported in Australia	▪ costly outbreaks reported in Hong Kong and South Africa
SPREAD	▪ aerosols of nasal discharges ▪ cough can spread virus up to 35 m ▪ fomites (e.g. transport vehicles) ▪ rodents/flies - mechanical vectors	▪ could have **EXPLOSIVE SPREAD** between horses, as Australian horses have never been exposed (are naïve)
I.P.	▪ usually 1 to 5 days	▪ **SHORT!!!**
CLIN. SIGNS	▪ fever, nasal discharge, off food ▪ **PERSISTENT (2-3 days), dry, hacking COUGH** ▪ **many** horses affected ▪ foals may get pneumonia and die (more severely affected) ▪ signs resolve by 1-3 weeks, but some horses need long term rest	▪ **infective period** (time that infected horses can give virus to another horse) is a maximum of 14 days (including 2 days before and 8 days after first signs) ▪ no **carrier state**
DIFF. DIAG.	1. Viral or Bacterial Respiratory Infections 2. Shipping Fever/Travel Sickness 3. Inflammatory Airway Disease (allergic or environmental) 4. Lung Worms 5. African Horse Sickness*	▪ respiratory disease is **common** ▪ **<u>many</u> horses with signs of disease is a <u>KEY SIGN</u>**
DIAGNOSIS	▪ **virus isolation** – nasal washes/deep nasal swabs ▪ **serology** – paired serum samples, 10-14 days apart	▪ chill all samples on **ice**
COSTS	▪ **may require cancellation of horse events** (races, shows etc) ▪ **major vaccination campaign** an added cost	▪ **potentially very large economic losses**
ERAD.	▪ likely to “burn itself out” within 6 to 12 months ▪ but may become endemic (as it has in other countries)	▪ **vaccines** available, but have variable, often short term efficacy, and are strain specific

5.2 African Horse Sickness[17,23,27,42,59,75,97,118]

KEY SIGNS: severe respiratory distress and/or oedema (swelling), especially above the eye

Special considerations:

- ***AHS is an OIE List A disease as it is a severe disease and can cause large numbers of deaths in an outbreak.***
- An AUSVETPLAN is available at http://www.aahc.com.au/ausvetplan.
- If the disease were introduced to Australia there could be difficulties in eradication due to the presence of potential arthropod vectors (*Culicoides* spp) and a large population of feral horses and donkeys where Culicoides spp can be found[55].
- If a strain with low virulence were introduced to Australia there may be problems in early detection or recognition of disease[158]. This may allow the disease to become established (endemic) which would have ***major*** implications for our ***trade*** in horses.

Figure 5.2: Swelling over the eye (supraorbital fossa) in a horse with AHS.

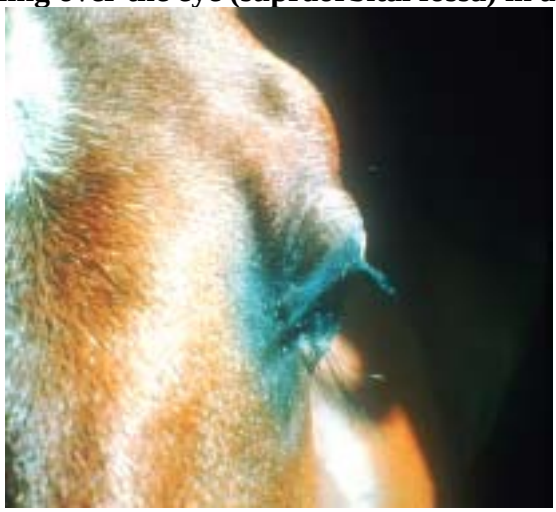


Figure 5.3: A horse that has died from AHS with a large amount of foamy fluid found in nasal passages and trachea.

CATEGORY	WHAT?	IMPORTANCE?
CAUSE	▪ an insect-borne **virus** - genus ***Orbivirus*** ▪ 9 different serotypes (strains)	▪ no cross immunity between serotypes therefore vaccines need to include all serotypes ▪ several doses of vaccine required for immunity
HOSTS	▪ horses, mules, donkeys (less susceptible), dogs ▪ elephant and zebra - subclinical	▪ zebra do not get clinical disease, but act as **reservoir hosts**
WHERE	▪ endemic in parts of **Africa - south of the Sahara** ▪ periodically disease spreads north to Egypt, the Middle East, Portugal, Spain and east to the Indian subcontinent	▪ climatic conditions similar to parts of Australia in these countries
IN AUST.	▪ never reported in Australia	
SPREAD	▪ **no <u>direct</u> transmission** between horses ▪ transmitted by insect vector (**primarily *Culicoides* spp – biting midges** – but other insects experimentally shown to transmit disease, e.g ticks, mosquitoes ▪ wind-borne spread of vectors over long distances may occur	▪ need infected insect to be brought to Australia or a sick horses that is subsequently exposed to insect vector ▪ *Culicoides* spp in Australia near populations of feral donkeys and horses (which could become endemically infected)
I.P.	▪ 3 to 21 days (usually 5 – 9 days)	
CLIN. SIGNS	**<u>4 Syndromes:</u>** 1. **Lung (Pulmonary) Form;** severe **respiratory disease**, may see froth coming from nose; often fatal; 2. **Heart (Cardiac) Form;** see oedema (swelling) of the head, above the eyes (supraorbital fossa) and ventral midline, may see bruises on mucous membranes. Fatality rate is variable. 3. **Mixed Form** – combines features of both lung and heart forms. Fatal within 3 – 6 days. 4. **Horsesickness Fever** – mildest form and frequently subclinical. Develop fever for 5 – 8 days and then recover.	
DIFF. DIAG.	1. Anthrax 2. Purpura haemorrhagica 3. Plant/Chemical poisoning 4. Equine Infectious Anaemia (EIA) 5. Drug Reaction (anaphylaxis) 6. Equine Morbillivirus (respiratory disease) 7. Insect bites 8. Heat Stress 9. Equine Babesiosis* 10. Equine Viral Arteritis* 11. Surra*	
DIAGNOSIS	▪ blood for **viral isolation** ▪ serum for **serology**	
COSTS	▪ potentially devastating ▪ severe restrictions on movement/trade	▪ public concern
ERAD.	▪ difficult if establishes in insect vector ▪ virus very stable outside of host; can live in putrid blood > 2 years)	▪ vaccines available

5.3 Contagious equine metritis[42,58,67, 147,159]

KEY SIGNS: copious grey discharge from vulva; especially if seen in multiple mares bred to recently imported stallion

Special considerations:

- ***Breeding horses (stallions and mares) can become carriers*** of the causative agent, and do not demonstrate clinical signs. These horses are the most likely source for introduction of the contagious equine metritis (CEM) to Australia.
- The disease has already been introduced to Australia once (first identified on a Thoroughbred stud in 1977), and was very costly to eradicate. It is anticipated that the cost of eradication would again be high were it to be re-introduced.
- There is also the possibility of spread to other breeds of horses (non-Thoroughbred), from which disease could be harder to eradicate.
- ***The most relevant warning sign is an unexpected return to service of <u>multiple</u> mares that have been served by the <u>same</u> stallion, especially if the mares have a vaginal discharge.*** Copious, grey vulval discharge from a mare should also be treated with suspicion.
- An AUSVETPLAN has been produced for CEM (http://www.aahc.com.au/ausvetplan/)

Figure 5.4: Copious amounts of grey discharge from vagina of infected mare.

Figure 5.5: Swab of clitoral fossa for detection of *Taylorella equigenitalis.*

CATEGORY	WHAT?	IMPORTANCE?
CAUSE	▪ a bacteria - ***Taylorella equigenitalis***	
HOSTS	▪ **horses (**and donkeys) ▪ donkey strains may infect horses and vica versa	
WHERE	▪ widespread in Europe (including cases in 1996 in UK, and in 1999 in Switzerland), also in Japan ▪ never reported in New Zealand and South Africa	▪ CEM-like bacteria isolated from donkeys in US in 1997 and 1998
IN AUST.	▪ no ▪ last outbreak in 1977, last case reported in 1980	▪ Australia officially declared CEM-free in 1985
SPREAD	▪ during **natural breeding** or possibly with infected semen during **AI** ▪ also via fomites (e.g. speculum) ▪ congenital spread (to foetus)	▪ genital-to- genital or genital-to-nose transfer reported ▪ role of **teaser stallions** in spread
I.P.	▪ 1 – 3 days (but as long as 12 days)	
CLIN. SIGNS	▪ only 30-40% of mares served by infected stallion have clinical signs ▪ usually seen as **copious, greyish, vulval discharge** which may last 3 – 4 weeks; early abortion and foetal resorption can occur but rare ▪ some mares don't have a discharge, but have pooling of greyish fluid in the anterior vagina ▪ some mares don't have outward signs ; infection is seen as an early return to service ▪ **mares may become <u>CARRIERS</u>** - bacteria remaining in the clitoral sinuses and fossa. These mares are the major **reservoir** of infection. ▪ most **stallions do not have clinical signs,** but may remain **inapparent <u>CARRIERS</u>** in their urethral fossa and prepuce	
DIFF. DIAG.	1. bacterial metritis/endometritis e.g. a. *Streptococcus equi* ssp *zooepidemicus* b. *Klebsiella pneumoniae* (especially capsule types 1,2 + 5) c. *Pseudomonas aeruginosa* 2. other causes of infertility in mares 3. other causes of infertility in stallions; or poor quality semen if AI	
DIAGNOSIS	▪ **swabs** from suspected mares and stallions ▪ **culture organism** – special media and conditions required ▪ **need a total of 3 samplings at 7 day intervals** ▪ serology (limited value)	▪ Amies charcoal medium preferred for transportation of swabs
COSTS	**COST OF OUTBREAK OF CEM in AUSTRALIA IN 1977-83** ✓ $1M Routine mare swabbing ✓ $12M export losses ✓ $500 export testing per mare ✓ $250,00 -500,000 cost per infected studs	
ERAD.	▪ possible, but expensive	▪ no vaccine available

5.4 Exotic diseases causing neurological signs

Special considerations:

- This is a group of diseases that affect the nervous tissues (mostly brain and spinal cord).
- ***They frequently have the same clinical signs.***
- Most of these diseases are caused by ***viruses***, but a ***protozoa*** causes one disease (equine protozoal myeloencephalopathy).
- Most of these infections are also ***ZOONOTIC*** (affect humans), and strict care should be taken during diagnosis.
- Most are ***OIE list B*** diseases. AUSVETPLANS are available for ***rabies*** and ***Japanese encephalitis*** at http://www.aahc.com.au/ausvetplan/.
- Horses (and humans) are considered ***"dead end hosts"*** for **most** of these infections (not Venezuelan equine encephalomyelitis). A dead end host is one in which the organism does not multiply to sufficient numbers to be able to be transmitted back to the insect vector, or onto other hosts. This is ***important*** as it means ***that horses are very unlikely to be the source of an outbreak of disease in Australia.***
- Diseases include: Rabies
  Venezuelan Equine Encephalitis
  Japanese Encephalitis
  West Nile Virus
  Western and Eastern Equine Encephalomyelitis
  Equine Protozoal Myeloencephalitis

KEY SIGNS: horses could have:
- ✓ fever and signs of depression
- ✓ be wobbly (ataxic) or stagger
- ✓ tilt their head and walk in circles
- ✓ lie down and be unable to stand (paresis and/or paralysis)

DIFFERENTIAL DIAGNOSES for horses showing NERVOUS SIGNS:

1. Wobblers (Cervical Vertebral Malformations)
2. Trauma (head or spinal cord)
3. Plant Poisoning e.g. Pyrrolizidine alkaloids (hepatoencephalopathy)
4. Bacterial meningitis/encephalitis
5. Tetanus
6. Botulism
7. *Indigophera* plant poisoning (Birdsville Disease)
8. Poisons e.g. heavy metals, organophosphates
9. Leucoencephalomalacia (fungal toxins or mycotoxicosis)
10. Yellow Star Thistle poisoning (Nigropalladial Encephalomalacia)
11. Verminous Encephalitis
12. Cauda Equine Neuritis
13. Middle Ear Disease
14. Equine Viral Encephalitis (Murray Valley Virus, Kunjin virus)
15. Equine Viral Encephalitides* (Rabies, JE, WNV, VEE/WEE/EEE, Borna, EE, EHV-1)
16. Equine Protozoal Myeloencephalitis*
17. Equine Degenerative Myeloencephalopathy*
18. Equine Motor Neurone Disease*

5.4.1 Rabies[34,42,46,53,61,98]

CATEGORY	WHAT?	IMPORTANCE?
CAUSE	▪ a **virus** - genus ***Lyssavirus***	▪ 7 genotypes, genotype 1 is classical rabies virus ▪ **OIE list B disease**
HOSTS	▪ all mammals, **including horses and humans**	▪ can affect different species variably
WHERE	▪ worldwide – **except** Australia, NZ, Japan, Singapore, Hawaii, UK PNG, Pacific Islands and Antartica	
IN AUST.	▪ absent ▪ there have been 3 reported cases of rabies in humans in Australia after they were infected overseas	▪ a closely related virus, Australian Bat Lyssavirus (ABL) is present in Australia ▪ ABL has caused the deaths of 2 Australians
SPREAD	▪ bite wounds from infected animals or via aerosols in bat caves ▪ virus cannot invade intact skin, but can infect fresh wounds ▪ some animals (e.g. **horses**) are considered "**dead end hosts"** ▪ virus is maintained in **urban** (dog) or **sylvatic cycles** (wild animals; skunk, fox, racoon, bat) ▪ virus can be found in saliva up to 7 days before signs may appear	▪ horse to horse transmission cycles have never been demonstrated (no species adapted strains) ▪ so the virus cannot be maintained in the horse as it can be with some other species e.g. dogs, foxes ▪ but rabid horses can transmit the virus to handlers and potentially to other horses
I.P.	▪ usually between 14 to 90 days ▪ but very variable (4 days to 6 months)	▪ long incubation period in some cases; but these are "dead end hosts"
CLIN. SIGNS	Depends on area of nervous system affected – **3 forms**: 1. **Dumb Form** (brainstem) – horse is dull and quiet 2. **Paralytic Form** (spinal cord) ▪ most common form in horses in North America ▪ horses are wobbly (ataxic), lose tail and anal sphincter tone, eventual become paralysed 3. **Excitable Form** (brain) – horses are hyper-excitable	
DIFF. DIAG.	1. causes of **Neurological Signs** – see list on page 42 2. choke 3. causes of mild colic 4. Crotalaria poisoning	
DIAGNOSIS	▪ **brain** for immunoperoxidase test ▪ if **<u>any doubts</u>** contact authorities	▪ **extreme caution** needed when diagnosing rabies
COSTS	▪ economic and social impact	▪ public concern
ERAD.	▪ could be very difficult to eradicate if became established in sylvatic cycle in foxes, dingoes, feral dogs, bats	▪ infected horses are very unlikely to be the source for a sylvatic cycle in Australia

Special considerations:

5.4.2 Venezuelan Equine Encephalomyelitis [42, 100,127,158,160]

- Caused by an ***alphavirus*** in the family Togaviridae; Venezuelan equine encephalomyelitis virus (VEE) is closely related to western equine encephalomyelitis virus (WEE) and eastern equine encephalomyelitis virus (EEE).
- ***Horses*** are the ***major amplifying host*** for ***VEE***, but not for EEE or WEE where they are "dead end hosts".
- ***The virus can be transmitted from horse-to-human (zoonotic) or horse-to-horse via an infected insect vector.*** VEE is widely thought to be the most important equine infectious disease that is transmissible to man in the Americas.
- In general, VEE causes larger outbreaks of disease in horses (and humans) than EEE or WEE, and together with EEE has a high death rate (case fatality rate) in horses (40% to 80%).

5.4.3 Japanese Encephalitis (JE) [31,42,99]

- Japaneses encephalitis is ***an emerging disease*** and is currently detected annually on islands in the Torres Strait, ***very close to mainland Australia***.
- In 1995 there were 3 cases of JE (2 fatal) in ***humans*** and serological evidence of infection in pigs, dogs, and ***horses*** on Badu and other islands in Torres Strait, but not Australian mainland[52.] Ongoing serological evidence of this virus was reported in 1996-97.
- In 1998 a further case of JE in a ***human*** was reported on Badu Island, and another case on the ***Australian mainland*** on Cape York Peninsular (Mitchell River area). There was ***no evidence of horses*** infected on the Australian mainland at this time.
- In 1999 - 2001 antibody to JE virus detected in pigs on Badu Island, but not the mainland.
- Infected windblown mosquitoes from Papua New Guinea are thought to be the likely source of JE virus for Badu Island and Australian mainland.
- ***Horses are usually "dead end hosts"*** for JE virus infection.

Figure 5.6: Horse with neurological disease. Note the asymmetry of stance, neck bend and head tilt.

Figure 5.7: Horse with neurological disease. Note the twisted neck and abnormal stance. This horse was also blind.

CATEGORY	VENEZUELAN ENCEPHALOMYELITIS	JAPANESE ENCEPHALITIS
CAUSE	▪ a **virus - *alphavirus*** ▪ 2 antigenic variants (1AB and 1C) are responsible for most outbreaks (epizootics) in horses and humans	▪ a virus - ***flavivirus*** ▪ related to Murray Valley Encephalitis virus, which is present in Australia
HOSTS	▪ birds, rodents,**horses, humans**, other animal species ▪ **horses and humans are the only species to develop disease (epizootic strains only)**	▪ birds, pigs, **horses, donkeys, humans**
WHERE	▪ predominantly South America, occasionally, central America and USA	▪ East Asia, SE Russia, India, Papua New Guinea, **Torres Strait Islands**
IN AUST.	▪ **never** reported in Australia	▪ **mainland in 1998**, but no evidence of infection in horses ▪ **no sylvatic cycle established**
SPREAD	▪ mosquito vector ▪ other blood sucking (haematophagous) insects play a role in outbreaks (epizootics) with mechanical transmission ▪ aerosol transmission from sick horses to humans possible	▪ mosquito vector ▪ equine imports unlikely source
I.P.	▪ 12 – 16 hours	▪ 4 – 14 days
CLIN. SIGNS	▪ 10-15% of cases are **subclinical** ▪ **clinical disease** seen as profound depression and lethargy; may become inco-ordinated, wobbly (ataxic) and walk in circles or head press ▪ may become blind and deaf ▪ terminal stages - horses become recumbent and comatose ▪ **case fatality rates** 19-83%	▪ many cases **subclinical;** ▪ three clinical forms; ▪ **transient fever;** off food ▪ **lethargic**-fever, wobbly (ataxia) ▪ **hyperexcitable**; rare (5%), may be violent or recumbent, ▪ **fatality rates** 5 – 40%
DIFF. DIAG.	▪ see list on page 42	▪ See list on page 42
DIAGNOSIS	▪ **brain/CSF/Serum** for virus isolation or RT-PCR ▪ **blood** – serology	▪ **brain/CSF/serum** for virus isolation or RT-PCR ▪ **blood** – serology
COSTS	▪ vaccination ▪ death of many horses possible if an outbreak of VEE occurs	▪ vaccination ▪ loss of trade
ERAD.	▪ difficult – vector control ▪ vaccine available, variable efficacy	▪ difficult – vector control ▪ vaccine available

Special considerations:

5.4.4 West Nile Virus (WNV) [19,107,108]

- In 1999 there was an incursion of WNV into North America and the virus has since become established in this region. This was the first time the WNV had been recorded in the Western Hemisphere. It is ***important*** as it is considered ***a significant threat to human and equine health in the USA***.
- In 2001 there were 738 cases of WNV infection reported in horses in the USA. Of the 470 horses for which an outcome was reported, 33.2% died or were euthanised[123].
- Horses are considered to be ***"dead end hosts"*** of this virus.

5.4.5 Western Equine Encephalomyelitis (WEE)[42,100]

5.4.6 Eastern Equine Encephalomyelitis (EEE)[42,100]

- Closely related to the Venezuelan equine encephalomyelitis (VEE) virus but horses are ***dead end hosts*** for these viruses, and are ***not involved in their transmission***

5.4.7 Equine Protozoal Myeloencephalitis (EPM)[25, 28,83]

- ***This is the most common cause of neurological disease in horses*** in North America.
- Horses are ***accidental and dead-end hosts***
- This disease is ***unlikely to establish in Australia due to lack of definitive host***; however an infected horse may be imported and diagnosed with disease

Figure 5.8: Life cycle of *Sarcocystis neurona*[84].

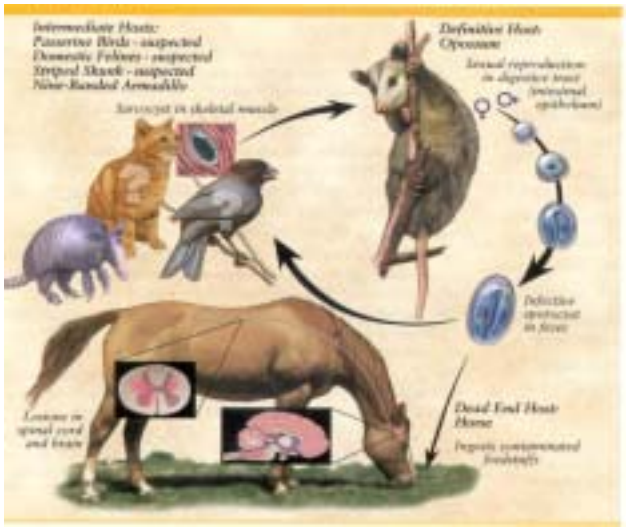


Figure 5.9: Gluteal muscle atrophy in a horse with EPM.

CATEGORY	WNV	EEE/WEE	EPM
CAUSE	▪ A virus belonging to the genus ***flavivirus***	▪ Viruses belonging to the genus ***alphavirus***	▪ a **protozoa,** most commonly ***Sarcocystis neurona*** ▪ occasionally ***Neospora hughesi***
HOSTS	▪ birds, **horses, humans**	▪ birds (including emus), mammals, **horses**, donkeys, mules, **humans**	▪ **horses** are **aberrant** and **dead end hosts** ▪ opposum are definitive hosts; intermediate host(s) include racoon and armadillo (others?)
WHERE	▪ USA, Canada, North Africa, Middle East, Asia, Europe	▪ North, Central and South America	▪ North, Central and South America
IN AUST.	▪ **never** reported in Australia	▪ **never** reported in Australia	▪ **never** reported in Australia
SPREAD	▪ mosquito vector ▪ (ticks in Asia/Africa)	▪ mosquito vectors ▪ cycle between insect vectors and birds and/or small mammals ▪ small outbreaks or sporadic cases occur in horses and humans	▪ ingestion of sporocysts in faeces of opossums ▪ ~ 50% of horses in parts of US are exposed to organism, but <1% of horses get disease
I.P.		▪ 1-4 days WEE/EEE	▪ variable; 28-42 days in experimental models
CLIN. SIGNS	▪ **subclinical** infections are common ▪ in **clinical cases** see fever, inco-ordination, weakness and paresis especially of hind limbs ▪ culminates in some cases in fatal encephalitis ▪ **case fatality rate up to 40%**	▪ **subclinical** infections are common ▪ in clinical cases see fever, hypersensitivity to touch and sound, muscle tremors, aimless circling and/or blindness, profound depression, ataxia, coma ▪ **Case fatality rate up to 90% for EEE**; lower rate for WEE (20-30%)	▪ many infections are **subclinical** ▪ clinical disease is characterised by a slow onset with progressive debilitation ▪ **early signs** – airway problems, unusual lameness, or seizures ▪ **severely affected horses** may have difficulty standing, walking or swallowing due to severe muscle weakness
DIAGNOSIS	▪ **brain/sc** for virus isolation or RT-PCR ▪ **blood** – serology	▪ **brain** for virus isolation or RT-PCR ▪ **Blood** – serology	▪ **clinical signs** – asymmetry of gait and focal muscle atrophy ▪ **serology** controversial ▪ **PCR** of CSF ▪ **Post Mortem -** organism seen in ~ 50% of cases ▪ **Difficult to diagnose**
COSTS	▪ vaccination ▪ moderate mortality rate	▪ vaccination ▪ high mortality rate for EEE	▪ treatment is expensive ▪ vaccination
ERAD.	▪ difficult – vector control ▪ unknown efficacy of current vaccine	▪ difficult – vector control ▪ vaccine available, variable efficacy	▪ should not establish in Australia due to lack of definitive host

5.5 Equine Babesiosis[16,37,42,43]

KEY SIGNS: may see fever, anaemia and jaundice (yellowing), most likely in an individual animal

Special considerations:

- This disease has been introduced to Australia[88], but has never established.
- The current situation for ***temporary imports*** of competition horses in Australia is that testing for Babesia is required, but horses with a positive blood test can be admitted under strict controls[3, 137,138]. Horses imported permanently must be tested negative
- Potential tick vectors may be present in this country[47], but suitable measures to prevent transmission to these vectors are in place.
- Some horses become lifelong carriers of *B. equi*, and the organism cannot be cleared from their blood even with treatment[73].

Figure 5.10: Horse with clinical babesiosis brought on by heat stress. Note ventral oedema and swollen fetlocks.

Figure 5.11: Tick vector of *Babesia spp* which transmit disease to horses.

Figure 5.12: Post mortem on a horse with babesiosis. Note yellow colour (jaundice) and large spleen.

CATEGORY	WHAT?	IMPORTANCE?
CAUSE	▪ **protozoal parasites** transmitted by ticks ▪ 2 species affect horses: ***Babesia equi*** and ***Babesia caballi***	▪ these parasites live in the red blood cells of horses
HOSTS	▪ **horses**, donkeys, mules (horses most susceptible), zebras	▪ **zebras** are an important **reservoir** for *B. equi*
WHERE	▪ Southern and Eastern Europe (e.g. Spain, Portugal, Russia) ▪ Africa, Middle East, India, China ▪ Caribbean, Central and South America	▪ distribution determined by **tick vector** ▪ *B. equi* more widely distributed than *B. caballi*
IN AUST.	▪ absent ▪ introduced on at least 2 occasions; Moss Vale (NSW) in 1976; WA in 1970s	▪ now eradicated ▪ disease did not become established
SPREAD	▪ **tick vectors** include *Dermacentor, Hyalomma, Rhipicephalus,* and possibly *Boophilus* ▪ **recovered horses may become chronic carriers of *B. equi*** ▪ intra-uterine infection can occur ▪ spread by unclean needles and surgical instruments has been reported in Australia and UK	▪ **recovered horses often have the organism in their blood – usually in very low numbers – which cannot be cured with drug therapy** ▪ if stressed the disease may recrudesce and the horse may transmit the organism to tick vectors ▪ can pass from dam to foal
I.P.	▪ variable	
CLIN. SIGNS	▪ **3 forms**: **acute, sub acute** and **chronic** ▪ the major clinical signs include fever, **anaemia**, and jaundice (yellowing); can cause abortion in pregnant animals ▪ acute disease may recrudesce in **carrier horses**, especially if the horse is stressed (e.g. has another disease such as colic, pneumonia etc)	
DIFF. DIAG.	1. Equine Infectious Anaemia 2. Plant and Chemical Poisoning 3. Equine Viral Arteritis* 4. Dourine*	5. Haemolytic anaemia 6. Purpura Haemorrhagica 7. Surra* 8. African Horse Sickness*
DIAGNOSIS	▪ **blood smears** (need to repeat on several occasions) ▪ blood for **serology**	▪ can be very difficult to detect in blood smears, especially if **chronic**
COSTS	▪ export losses and restrictions on trade	
ERAD.	▪ the difficulty in eradication will depend on whether there is a suitable tick vector in Australia ▪ it will be very difficult to eradicate if the parasite becomes established in tick populations	▪ *Rhipicephalus sanguineus* and *Boophilus microplus* are possible tick vectors present in Australia

5.6 Vesicular Stomatitis[42,64,71,78,90,91,98,136]

KEY SIGNS: vesicular lesions (blisters) especially in the mouth, coronary band, or external genitalia.

Special considerations:

- Vesicular stomatitis is a ***major disease*** **(OIE List A)** due to the fact that it is a ***indistinguishable from foot-and- mouth disease*** when it occurs in cattle, sheep and pigs**.** Subsequently this disease is subject to ***stringent regulations*** when it is suspected in any species, including horses.
- There is an AUSVETPLAN for vesicular stomatitis, http://www.aahc.com.au/ausvetplan/
- Outbreaks of vesicular stomatitis involving horses occur sporadically in North America. However, the disease has not spread out of the Americas.

Figure 5.13: Horse with vesicular stomatitis showing foot discomfort

Figure 5.14: **Lesion on coronary band**

Figure 5.15: **Lesions in mouth**

CATEGORY	WHAT?	IMPORTANCE?
CAUSE	▪ a **virus** - genus ***Vesiculovirus*** ▪ 2 serotypes – Indiana and New Jersey (most active)	▪ VS is a **notifiable disease** in all States and Territories; therefore veterinarians have a legal obligation to notify
HOSTS	▪ **horses, cattle, pigs**, llamas (range of other wild and domestic species) and **humans**	▪ **zoonotic** – humans develop a flu-type illness
WHERE	▪ North, Central and South America	
IN AUST.	▪ **never** been reported in Australia.	
SPREAD	▪ **not fully understood** ▪ transmitted through direct contact with lesions, saliva of infected animals, or contaminated fomites ▪ virus only enters through damaged skin and mucous membranes ▪ insects (flies/mosquitoes) involved in transmission in some outbreaks (either as mechanical vectors or as competent vectors)	▪ recent studies suggest that a viraemic host is **<u>not</u>** needed to transmit between insects, so the virus may be maintained solely in insect vectors ▪ rodents thought to act as **reservoir hosts**
I.P.	▪ 1 to 3 days (up to 10 days)	
CLIN. SIGNS	▪ fever ▪ eruption of well circumscribed, thin walled vesicles **(blisters), on the tongue, oral mucosa, udder, genitalia, and coronary bands** ▪ blister formation accompanied by excess salivation, inappetence, lameness and loss of condition	▪ **major importance for Australia is as a differential diagnosis of vesicular disease in pigs and ruminants**
DIFF. DIAG.	**Mouth Lesions** **1.** Phenylbutazone toxicity **2.** Irritation e.g. worming paste **3.** Mercury Blister **4.** Blister Beetle* **5.** Yellow Bristle Grass* **6.** Oral foreign body **7.** Peridontal Disease **8.** Equine Exfoliative Eosinophilic Dermatitis and Stomatitis	**Coronary Band Lesions** **1.** Bacteria e.g. *D. congolensis* **2.** Fungal dermatitis **3.** Pemphigus folliaceous **4.** Contact dermatitis due to ***Umbelliferae*** plants (e.g. Parsnips, celery, parsley) 5. Chemical irritants 6. Photosensitisation
DIAGNOSIS	▪ **virus isolation** – lesions, nasal washes/deep nasal swabs. ▪ **serology** – paired serum samples, 10-14 days apart.	▪ **if in real doubt – leave to specialist team due to <u>importance</u> of vesicular diseases**
COSTS	▪ possible losses to **horse industry** due to loss of export trade	
ERAD.	▪ it may be difficult to eradicate if it is introduced as little is known about the ecology of the virus	▪ never established outside Americas despite occasional introduction to other continents

5.7 Equine Trypanosomal Diseases

5.7.1 Surra[13,26,42,81,131,153,161]

5.7.2 Dourine[9,10,22,33,42,81]

KEY SIGNS: skin lumps (urticarial plaques) and oedema (swelling) of the genitalia, ventral midline and legs is seen in both diseases.

Special considerations:

- ***Surra is found in Indonesia*** and is therefore a risk due to its proximity to Australia.
- An import risk analysis for importation of horses from countries in which surra is endemic is currently being undertaken by Biosecurity Australia and an AUSVETPLAN is available for surra at http://www.aahc.com.au/ausvetplan.
- Surra may be introduced through infections in other species e.g. cattle, pigs, deer, dogs as well as horses, and the mechanical vectors (flies) are already present in Australia.
- ***Dourine*** is the only trypansomal disease not spread by insects; it is spread venereally.

Figure 5.16: Trypanosomes in the blood of a horse with surra

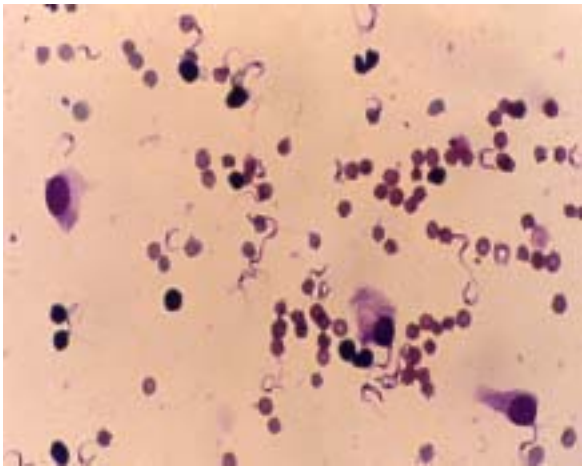


Figure 5.17: Scrotal oedema (swelling) in a horse with dourine.

Figure 5.18: Urticaria (lumps) in skin of a horse

CATEGORY	SURRA	DOURINE
CAUSE	▪ a protozoal parasite - ***Trypansoma evansi***	▪ a protozoal parasite - ***Trypansoma equiperdum***
HOSTS	▪ **wide range** of hosts including horses – disease **worst** in **camels, horses** and **dogs**	▪ **only** in horses, (donkeys, mules)
WHERE	▪ Africa, Middle East, Russia, India, China, SE Asia including **Indonesia**, Central and South America	▪ Africa, Russia, Middle East, SE Asia, Central and South America, Italy (1996)
IN AUST.	▪ absent; reported once in a camel in quarantine in 1907, but consignment was destroyed and disease did not establish	▪ never reported in Australia
SPREAD	▪ **biting flies** (Tabanids and Stomoxys) ▪ **mechanical transmission only**	▪ **venereal** – between stallions and mares ▪ mare to foal at parturition
I.P.	▪ 1-2 weeks	▪ 1-12 weeks (up to 6 months)
CLIN. SIGNS	▪ there are **acute**, **sub-acute** and **chronic** forms of the disease ▪ see fever, anaemia, wasting, weakness, exudation and alopecia (hair loss), oedema (swelling) of the legs and brisket ▪ **urticarial plaques (lumps) of the skin** ▪ may se nervous signs ▪ **death** in 2 weeks – 4 months	▪ **oedema (swelling)** of ventral midline and genitals; may see discharge from genitalia ▪ **urticarial plaques (lumps) –** especially of the flank, which become painful weeping ulcers ▪ later see non specific signs - weight loss, anaemia, ataxia (incoordination of hind legs), paralysis ▪ **death** in acute cases within 1 - 2 months in greater than 50% of cases (low morbidity/high mortality)
DIFF. DIAG.	1. African Horse Sickness* 2. Equine Babesiosis* 3. Equine Infectious Anaemia 4. Equine Viral Arteritis* 5. Chronic parasitism	1. Equine Infectious Anaemia 2. Coital Exanthema (EHV-3) 3. Surra*
DIAGNOSIS	▪ **smears** of blood/exudates ▪ **blood** for culture ▪ **blood** for serology	▪ **wet preparations** of vaginal or preputial scrapings, exudates or skin lesions ▪ **blood** for serology or PCR
COSTS	▪ considerable, as can infect a wide range of animals	▪ costs of eradication ▪ loss of valuable breeding stock
ERAD.	▪ difficult as can infect wide range of species and transmitted by biting flies which are widely spread in Australia	▪ dourine would be a controllable disease ▪ control would be more difficult if became established in feral horse population; but unlikely as venereally transmitted

5.8 Equine Ehrlichial Diseases

5.8.1 Potomac Horse Fever[29,42,86]

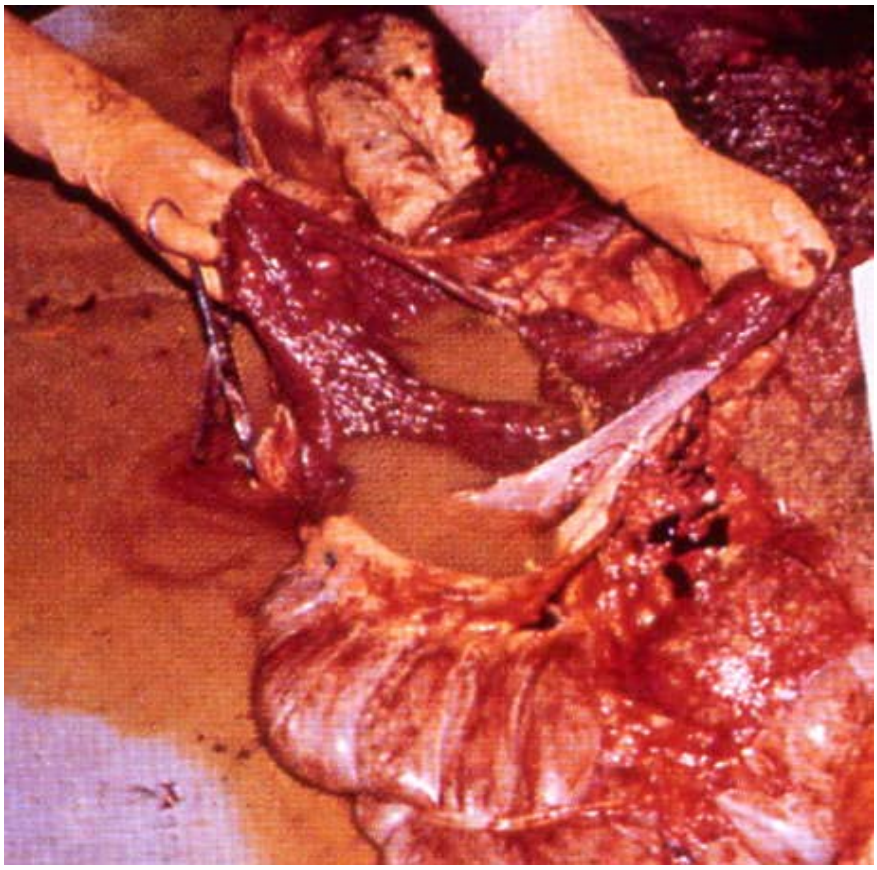
5.8.2 Equine Granulocytic Ehrlichiosis[86]

KEY POINT: Minor diseases, and unlikely to establish in Australia as would be picked up in PEQ or PAQ.

Special considerations:

- **Potomac Horse Fever (PHF)** is also called **Equine Monocytic Ehrlichiosis.**
- The causative agent of **Equine Granulocytic Ehrlichiosis** (*Ehrlichia equi*) is **closely** related to the organism that causes **Human Granulocytic Ehrlichiosis (HGE)** and may be the same organism. However, there is no evidence of direct horse-to-human transmission.

Figure 5.19: Post mortem examination of contents of large intestine in a horse with severe diarrhoea due to Potomac Horse Fever.



CATEGORY	POTOMAC HORSE FEVER	EQUINE GRANULOCYTIC EHRLICHIOSIS
CAUSE	▪ a **bacteria**, ***Ehrlichia risticii***	▪ a **bacteria, *Ehrlichia equi***
HOSTS	▪ only horses	▪ horses (possibly **humans)**
WHERE	▪ USA, Canada, France, Uruguay, Brazil	▪ USA, Canada, Brazil and Northern Europe
IN AUST.	▪ **never** been reported in Australia	▪ **never** been reported in Australia
SPREAD	▪ **ingestion** of a **trematode** (parasite) vector (either directly or if it is within second intermediate hosts such as an aquatic insect e.g. caddisflies)	▪ bite of tick vectors (*Ixodes pacificus*)
I.P.	▪ 1 to 3 days	▪ 10 to 20 days
CLIN. SIGNS	▪ fever, inappetance, signs of depression ▪ many develop profuse **diarrhoea** within 1-2 days, which may last up to 10 days ▪ may show signs of colic (of varying intensity), acute laminitis (20-30% of cases) and abortion ▪ fatality rates of 30% reported	▪ **subclinical** disease most common ▪ **clinical disease** includes fever, lethargy, partial anorexia, limb oedema, jaundice, and ataxia ▪ may have leucopaenia, thrombocytopaenia, anaemia ▪ rarely fatal (usually from secondary complications)
DIFF. DIAG.	1. Salmonellosis 2. Acute Undifferentiated Diarrhoea 3. Colitis X 4. Clostridial Enteritis 5. Antibiotic Induced Enteritis 6. NSAID Induced Enteritis 7. Endotoxaemia 8. Anterior Enteritis	1. Equine Infectious Anaemia 2. Equine Viral Arteritis 3. Early viral respiratory infections (e.g EHV-1/4) 4. toxaemia with bone marrow suppression 5. Purpura Haemorrhagica 6. Liver Disease
DIAGNOSIS	▪ **faecal culture** of organism – not available in Australia ▪ **serology** – of limited value ▪ **gut Samples** - for histopathology ▪ **PCR** – blood/faeces	▪ **blood Smear -** Identification of inclusions (morulae) in at least 3 neutrophils in a blood smear ▪ **serology** – 4 fold increase in titre ▪ **PCR**
COSTS	▪ probably limited ▪ effective treatment available (tetracyclines)	▪ probably limited ▪ effective treatment available (tetracyclines)
ERAD.	▪ unlikely to establish in Australia due to lifecycle ▪ vaccination available, and widely used in USA, but questionable efficacy	▪ difficult if became established in tick vectors ▪ no vaccine available

5.9 Equine Lymphangitis[1,6,39,42,68,74,130,157]

5.9.1 Epizootic Lymphangitis

5.9.2 Glanders

KEY POINT: Minor diseases, and unlikely to establish in Australia as would be picked up in PEQ or PAQ.

Special considerations:

- Glanders and epizootic lymphangitis have been eradicated from common trading partners (UK, Western Europe, North America); but remain in other parts of the world.
- Risk of entry into Australia is low.
- Abscessation of lymph nodes is a ***common presentation in both diseases.*** Glanders also has a pulmonary form of disease, which is the most common form in horses. Onset of clinical signs may be insidious.
- The organism causing glanders (*Burkholderia mallei*) may also infect people – and fatality rate is as high as 95% occurs in untreated humans.

Figure 5.20: Skin sores on the lower limb of a horse with "Epizootic Lymphangitis"

Figure 5.21: Infection of lymphatic chain in subcutaneous tissues, with "cording" of lymphatic vessels in a horse with "Epizootic Lymphangitis"

CATEGORY	EPIZOOTIC LYMPHANGITIS	GLANDERS
CAUSE	▪ a fungus – ***Histoplasma capsulatum* var *farciminosum***	▪ a bacteria – ***Burkholderia mallei*** (formerly *Pseudomonas mallei*)
HOSTS	▪ horses, mules, donkeys, camels, rarely cattle	▪ horses, mules, donkeys (dogs, cats), **humans**
WHERE	▪ Africa, Middle East, Europe (near Mediterranean), Central Asia, Central America	▪ China, Myanmar, India, Pakistan, Mongolia, Eastern Europe, Middle East, SE Asia, Northern Africa
IN AUST.	▪ never reported in Australia	▪ absent; reported in 1891 in a circus horse in quarantine but immediately eradicated
SPREAD	▪ direct contact with infected animals, or via fomites or insects ▪ via inhalation, skin abrasions or during coitus ▪ insects involved in ocular spread ▪ survives in soil 15 days	▪ nasal and skin discharges of infected horses **highly contagious** ▪ infection via ingestion (mainly), inhalation, or skin abrasions ▪ latently infected horses - reservoirs ▪ survives in soil 2 months
I.P.	▪ 6 – 8 weeks	▪ as short as 6 days, usually 2-6 wks
CLIN. SIGNS	▪ usually a **chronic disease** ▪ seen as **painful abscesses of lymph nodes** and granuloma formation ▪ mostly on head, neck and later legs ▪ eventually abscesses rupture with much pus discharged ▪ lymphatic vessels linking infected lymph nodes become thickened **("cording" of vessels**) ▪ ocasionally other sites involved (e.g. liver, spleen, joint) ▪ low mortality rate	▪ acute, chronic or latent forms ▪ acute disease mostly in donkeys or mules – upper and lower respiratory tract signs; death 1-2 weeks ▪ **chronic disease mostly in horses** and may have 3 forms: ▪ ***Pulmonary Form*** = **"Glanders"** ▪ ***Skin Form*** = **"Farcy"** ▪ ***Nasal form*** ▪ malaise, cough, weight loss, fever ▪ get **nodule formation and ulceration in nasal mucosa**, lungs, local lymph nodes and skin
DIFF. DIAG.	1. Strangles (*Streptococcus equi*) 2. Cryptococcosis (*Cryptococcus* spp) *3.* Sporotrichosis (*Sporothrix schenkii*) *4.* Vasculitis *5.* Ulcerative Lymphangitis (*Corynebacterium pseudotuberculosis)** *6.* Glanders (*Burkholderia mallei*)*	1. Strangles (*Streptococcus equi*) 2. Meliodosis (*B. pseudomallei)* 3. Subcutaneous Fungal or Oomycete Infections (e.g. Sporotrichosis, Blastomyces or Pythium spp) 4. Ulcerative Lymphangitis (*C. pseudotuberculosis)* 5. Habronemiasis 6. Epizootic Lymphangitis (*Histoplasma farciminosum)**
DIAGNOSIS	▪ **direct smears** of pus sample – many characteristic fungi present ▪ **culture** of pus samples	▪ **Mallein Test** ▪ **blood** for culture/serology ▪ **pus** for culture
COSTS	▪ eradication costs	▪ trade implications ▪ public health concerns
ERAD.	▪ achieved in parts of Europe ▪ vaccine reported - efficacy unknown	▪ possible, but may be prolonged if disease reaches feral horse population

5.10 Miscellaneous Equine Exotic Diseases

5.10.1 Exotic Diseases that predominantly affect Horses

5.10.1.1 Equine Encephalosis (EE)

Equine encephalosis (EE) is caused by an *orbivirus,* which is in the same genus as the virus causing African horse sickness[23,76,97,114]. The virus was first identified in South Africa in 1967, and reports of disease arise predominantly from this country. However, serological evidence of the virus occurs in other parts of southern Africa, including Namibia, Zimbabwe, Kenya and Botswana[42,114,156]. Isolation of the virus has never been reported outside of southern Africa.

It is suspected that an insect vector, probably a *Culicoides* spp, is involved in transmission of the EE virus to horses, however, this has not been definitively proven[156]. Only horses are known to suffer from clinical disease, but there is serological evidence that infection of donkeys and zebra occurs[23,114,156]. In addition, although there is evidence for widespread infection of horses in South African, acute disease is observed only sporadically and with a relatively low prevalence[114]. Affected horses usually show only mild clinical signs (e.g. fever) and recover uneventfully. However, less common but more serious disease can occur and signs include jaundice, respiratory distress, and small bruises (petechial haemorrhages) on the mucous membranes. These clinical signs closely resemble equine babesiosis, which is the major differential diagnosis in South Africa. Signs of heart failure may also be present and pregnant mares may abort. More rarely are nervous signs exhibited such as ataxia (wobbliness) especially of the hind limbs, depression, frenzy and convulsions. These signs are attributed to oedema (swelling) of the brain rather than an inflammatory process. The case fatality rate is generally low at less than 5%.

Diagnosis of the disease involves isolation of the virus from the blood of infected horses. Alternatively, detection of antibodies in the blood of suspected cases using an ELISA may be used, especially in countries in which the disease is not found. In South Africa, the fact that specific antibodies are commonly found in the serum of horses makes this test less useful.

There is currently no vaccine available for equine encephalosis virus infection.

5.10.1.2 Borna Disease

Borna disease is an infectious viral disease that primarily affects horses and sheep, but can affect a range of other species including cats, cattle, goats, rabbits and possibly humans[125]. It is caused by Borna disease virus, and although there currently remains much that is unknown about this virus it is receiving increasing attention as an emerging pathogen in recent years[82,96,125,126,140].

The clinical syndrome, Borna disease, is most commonly reported in horses in Germany, Switzerland and Austria[125], although unsubstantiated reports from other European countries and the Near East, have occurred. In addition, recent reports of Borna disease in a horse[140] and cow[106] have occurred in Japan, and are the only substantiated reports of this disease outside of Europe. However, there is increasing serological evidence for infection of horses

with the virus in other parts of the world, including France[40], and the USA[66], although clinical disease in these countries have not been reported. Our understanding of Borna disease is further complicated by the fact that there appears to be widespread infection of horses in areas of Germany, yet the disease is uncommon. It has been speculated that development of Borna disease, after infection with Borna disease virus, depends on the genetic makeup of a horse, its age and immune status, and on the genetic characteristics of a particular strain of virus[125].

There is little information on the natural route(s) of virus transmission. It is currently thought that the virus is shed in tears, saliva and nasal secretions of infected horses and transmission is thought to be direct to other susceptible animals[125]. There is no evidence that other animal species, such as rodents or insects, play a role in transmission. The incubation period ranges from 2 weeks to several months.

Infection in most animals results in seroconversion, but not disease. However, in a low percentage of cases, infection results in a meningoencephalitis (inflammation of the brain and meninges), leading to death one to four weeks after the onset of clinical signs in more than 80% of affected animals[125]. The clinical manifestations of Borna disease can vary between individual horses but most commonly includes depression, sleepiness, apathy, and stupor. Approximately 50% of horses with acute Borna disease develop disturbances in chewing and swallowing of food and water, and in final stages of food intake ceases. More specific neurological signs depend on the section of the central nervous system (CNS) that is affected and the extent of the inflammatory reaction, but Borna disease is the most common cause of CNS disease of horses in Germany[125].

Because of the multifocal nature of the brain lesions, the resulting clinical signs are not specific for Borna disease, and infection with a range of pathogens can result in similar clinical signs. These diseases have been discussed earlier in the section on exotic diseases causing neurological disease (page 42). A presumptive diagnosis of Borna disease can be made with the demonstration of Borna disease virus-specific antibodies in the serum and/or cerebrospinal fluid (CSF) of horses showing clinical signs consistent with Borna disease. However, it must also be noted that Borna disease virus-specific antibodies can be also found in the serum, but not the CSF, of clinically healthy animals. Alternatively, PCR may be used to detect viral RNA in cells from the CSF, and which assists in diagnosis. Post mortem findings may also assist in a diagnosis based on histopathological, immunohistochemical or virological evidence of disease.

With respect to control of Borna disease, it is important for veterinarians worldwide to be aware of this disease and to include it as a differential diagnosis of disorders involving the CNS of horses (or sheep). Attempts at verification of the diagnosis should be made, as this will provide international data on the prevalence of Borna disease and will allow control measures to be implemented to prevent its introduction to other countries. An attenuated vaccine is available, but its use has been discontinued in Germany since 1992 due to doubt regarding its efficacy[125].

5.10.1.3 Getah Virus

Getah virus, is an *alphavirus*, and is related to Ross River Virus which is present in Australia. Getah virus has been isolated once from a mosquito in Australia in the 1960's, but no further isolations have occurred since then, and it is now considered to be exotic. Clinical disease predominantly occurs in horses, and possibly young pigs, but a wide range of other species are affected subclinically, including humans, monkeys, cattle, water buffalo, goats, dogs, rabbits and birds[42].

The virus is transmitted to horses by mosquitoes, and a horse-mosquito transmission cycle occurs, but pigs may also be an amplifying host[38]. Direct horse-to-horse transmission is suspected to occur through inhalation of virus infected aerosol droplets, but this method of transmission is thought to be rare in outbreaks of the disease. Getah virus has been isolated from mosquitoes in most countries in North-East and South-East Asia, but epidemics of Getah virus disease have only been recorded in horses in Japan and India[14,38], and these occur very infrequently.

The clinical signs include fever (lasting 1 to 4 days), with inappetence and signs of depression[38]. A skin rash and lumps may appear on the neck, chest and thighs. There may be oedema of the legs, particularly around the fetlocks, and also of the scrotum. Recovery usually occurs within a week and there are very few fatalities.

The differential diagnoses that must be considered include other causes of urticaria (skin rash and lumps) such as drug reactions or insect bites. Diagnosis of the disease is best performed on whole blood obtained from horses with a fever for viral isolation[38]. Alternatively, virus can be isolated from nasal swabs or saliva. Serum samples (acute and convalescent) for serology may also be collected.

5.10.1.4 Salmonella abortus equi

This bacteria is a serotype of Group B *Salmonella enteritidis*, however, *S. abortus equi* does not occur in the intestinal tract nor has it been isolated from faeces. *Salmonella abortus equi* is an equine host adapted bacteria that causes abortion in mares[133]. Transmission of infection is probably by ingestion of contaminated material, although cervical relaxation and consequent ascending infections have been implicated[85]. The existence of a carrier state, as with other host adapted Salmonella, is not addressed in the literature, but after introduction of infection on a stud, the primary abortion storm is followed only by abortion in introduced mares. Therefore either a carrier state, or lifelong immunity following infection, probably exists.

Abortion due to *Salmonella abortus equi* is relatively rare, and occurs sporadically worldwide, especially in Africa and Asia. Infection used to be reported frequently in Europe and USA, but is now reported only from Eastern European countries. The last reports in Europe were in the early 1980's, until an outbreak in Croatia in 1993-1994[85]. In this outbreak, 21 of 26 pregnant mares aborted between 5-10 months of gestation. In addition, joint ill and navel ill were reported in foals at foot. It was postulated that a carrier mare(s) was present in the herd and due to the presence of unknown stressors (altered diet or environment) began to shed the bacteria into the environment associated with the recrudescence of infection. The *S abortus equi* subsequently infected other mares due to horizontal transmission. Introduction of this

pathogen into a group of pregnant mares in Australia could potentially cause a similar outbreak before control measure could be implemented, with the loss of valuable stock.

5.10.1.5 Horse Pox

Horse pox is an OIE list B disease of horses, although the causal agent is not recorded, and the disease is poorly defined. Historical references to Horse pox virus exist[35], but there have been no recent infections reported worldwide[36]. Lesions resembling papillomas (warts) are found on the head, neck, flank and abdomen of affected horses[35]. Lesions may appear intermittently for some years in the same horse.

Uasin Gishu is a disease which causes similar clinical signs to horse pox and occurs in an area of the same name in Kenya[65]. There are reports of this syndrome from other parts of central Africa. It is thought to be transmitted to horses from an unknown wildlife source, possibly an unknown arthropod vector. The disease is not seen outside enzootic areas, despite the lack of movement control.

Equine molluscum contagiosum is a mildly contagious condition, which is clinically and histologically (microscopically) similar to *Uasin Gishu* disease, and has been reported in Southern Africa associated with pox virus particles in the lesions[77]. The disease *molluscum contagiosum* also occurs in humans (including in Australia) and in kangaroos. Human and equine *molluscum contagiosum viruses* (MCV) have been compared and appear to be very similar, if not identical[142]. Closer comparison has not been possible as the virus has not been cultured. Neither *Uasin Gishu* disease or *molluscum contagiosum* satisfies the clinical or epidemiological pictures of the classical horse pox disease described historically.

5.10.1.6 Echinococcus granulosus var equinus

The parasite *Equinococcus granulosus* occurs in Australia and is the cause of a *Hydatid Disease* in humans. This parasite is usually transmitted between dogs (definitive host) and sheep (intermediate host), although other animals may act as either definitive host (foxes, dingoes) or intermediate hosts (cattle, goats, kangaroos). However, the strains (varieties or "var") of parasite that are present in Australia do not infect horses. A strain of *E. granulosus* exists in other parts of the world that can infect horses (*E. granulosus* var *equinus*) and is spread between dogs and horses. This horse specific strain of the parasite is recognised by the OIE to occur in the UK, Ireland, Spain, Switzerland, Belgium, Italy and possibly North America[109]. Humans, and domestic species, are not considered to be intermediate hosts for this parasite[117], unlike the other strains of *E. granulosus* found in Australia. Introduction of this disease to Australia is unlikely, as it would require infective material (offal from infected horses) to be fed directly to dogs.

5.10.2 Exotic Diseases that Predominantly Affect other Species

5.10.2.1 Lyme Disease

Lyme disease is caused by the bacteria *Borrelia burgdorferi*. There is considerable controversy as to whether this bacterium occurs in Australia[60,101,129], but it is an important cause of disease in North America, and to a lesser extent Europe, where it infects humans as well as a range of domestic species (dogs, cattle, horses) and wild animals (rodents)[155]. *Borrelia burgdorferi* is generally transmitted to animals by *Ixodid* ticks, when the infected tick transfers from one infected animal (usually a rodent) to a second susceptible animal, or accidentally to a human[155]. There are reports of infection of horses with *B. burgdorferi* in the literature in North America[87] and the UK[20], although most reports do not involve specific isolation and identification of the agent, rather rely on serological data. Infection in horses has been associated with lameness, anterior uveitis (eye problems), and neurological signs in horses[110]. However, many seropositive horses do not show clinical signs of disease, as is the case in humans and dogs[20].

The importation of infected horses could serve as an initial focus of infection in Australia, especially if these horses are subsequently exposed to potential tick vectors. However, as this organism can infect a range of species, including humans, it may be potentially introduced to Australia in a number of different hosts, and for which there is currently no controls.

5.10.2.2 Nipah Virus

An outbreak of severe disease in pigs was reported in Malaysia in 1998-99 and was due to a newly recognised virus, Nipah virus[57]. This virus predominantly caused disease in pigs, but exposure of dogs, cats, humans, goats, and horses to infected pigs during the outbreak also resulted in their infection, with clinical signs varying between species infected[21]. The clinical signs were most severe in pigs, with moderate to severe interstitial pneumonia developing. The mode of initial transmission to pigs is unknown, but subsequent serological evidence of infection in fruit bats has implicated these animals as the source. In addition, dogs and cats were suspected of facilitating viral transmission between piggeries. Two horses from a property near the outbreak in pigs developed antibodies to the virus and were subsequently euthanased. However, neither of these horses had evidence of current infection. In addition, after an extensive serological survey, a further 3 horses were found to be positive by serum neutralisation test and ELISA, but were not showing signs of disease. One case of a horse demonstrating neurological signs has subsequently been shown to have Nipah virus antigen in the meninges[57], and it is assumed that Nipah virus may be able to cause a generalised vasculitis in some infected horses. However, infected horses are unlikely to spread the virus, and it is assumed that the five cases arose from transmission from infected pigs.

Nipah virus is a paramyxovirus and is closely related, but not identical with, Hendra virus[57]. This agent could have serious implications for the pig industry in Australia, were it to gain access to this country. However, unless horse populations were in close proximity to infected pigs, it is unlikely that they would be involved in outbreaks. This disease has not been recorded outside the Malay peninsular.

5.10.2.3 Nagana

Diseases caused by *Trypanosoma* spp. (*T. vivax, T. brucei* and *T. congolense*) that are transmitted by **tsetse flies** are collectively known as ***"nagana".*** This disease is distinct from the other diseases of horses that are caused by *Trypansomes* (dourine and surra). Nagana is characterised by recurrent fever, lower limb oedema, anaemia, and jaundice[70]. Some animals die within weeks of the onset of clinical signs.

Transmission of these parasites mostly occurs when a cow (or horse) is bitten by a tsetse fly, in which the organism has a phase of its lifecycle within the salivary glands. Tsetse flies are restricted in distribution to Africa. However, mechanical (direct) transmission of the parasite can also occur, especially with *T. vivax*. This is of concern for introduction of the disease to Australia, as a number of biting flies occur in this country, and may enable establishment of this disease in our cattle and horse population. Although these trypanosomes are primarily parasites of cattle, (as the tsetse fly has a marked preference to feed on this species), infection of horses and donkeys are common in areas where the disease is endemic[134].

5.10.2.4 Louping Ill

Louping ill is cause by a *flavivirus* (Louping Ill virus) and is associated with encephalitis, mostly in sheep, but also affecting multiple other species, including horses and occasionally humans[144]. The disease has been diagnosed in the UK and a number of European countries[41]. *Ixodes ricinus* (sheep tick) is the only identified vector, with a range throughout Europe, parts of North Africa and limited areas of Asia. The tick vector does not exist in Australia. If this virus were introduced to Australia it would predominantly affect the sheep industry, but other industries such as the equine industry, would also be affected. In addition, there are public health concerns associated with introduction of Louping Ill virus.

5.10.2.5 Trichinellosis (Trichinosis)

This disease is caused by parasites within the genus *Trichinella,* predominantly *T. spiralis*. The disease affects humans who eat improperly cooked infected meat, usually pork products. However, outbreaks of trichinellosis have occurred in Europe due to consumption of horsemeat, although these outbreaks have been restricted to France and Italy where horsemeat is eaten raw[121,154]. In recent years, most of these cases of human infection have been attributed to horses imported from Eastern European countries, and are due to inadequate veterinary controls at the time of importation. Horses are infected with the parasite by the consumption of prepared feed contaminated with infected rodent carcases[42] or pig products[122]. Clinical disease is rarely diagnosed in animals, but in humans signs include fever, muscle pain and weakness.

The importation of *trichinella* cysts in a live horse has the potential to establish infection in domestic pets and thence rodents in Australia. The establishment of *T. spiralis* in Australia has implication for a number of export markets, particularly pork. Horsemeat exported to Europe is presently tested for *trichinella,* despite the absence of this parasite from animals in Australia.

5.10.2.6 Foot-and-Mouth Disease (FMD)

This disease is caused by the foot-and-mouth disease virus and affects predominantly cloven footed animals (Artiodactyla). ***This disease is the most important exotic disease world-wide and is an OIE list A disease.*** Horses are ***not susceptible to infection***[89], however there is the possible potential for mechanical transmission of virus by this species. Consequently, outbreaks of this disease may affect importation of horses to Australia, and disinfection procedures are in place for horses from FMD endemic regions[4].

5.10.3 Organisms present in Australia, but not strains causing disease

There are a number of organisms that have different strains with variable ability to cause disease. In some cases, the disease-causing strains are found overseas but not in Australia. Therefore, although we may have the organism here in Australia (and you may have heard of them), we do not have the strains that cause disease. Alternatively, the strains present in Australia may cause some, but not all, forms of a disease.

It is just as important to prevent entry of these disease-causing strains into Australia, as we do not wish for our horses to succumb to these disease processes. In addition, some of these diseases have significance for the global trade in horses and semen, and consequently could affect our export markets.

5.10.3.1 Equine Viral Arteritis (EVA)

The disease, ***equine viral arteritis*** (EVA) is caused by ***equine arteritis virus*** (EAV), and outbreaks have been reported in a number of countries including USA, Canada, the UK, Germany, Denmark, Switzerland, Austria, Poland and South Africa[103,145]. Infected horses may present with signs of depression, anorexia (inappetence), oedema (swelling) of the lower limbs, scrotum or mammary gland, periorbital oedema and conjunctivitis ("pink eye"), jaundice (yellowing), respiratory signs (nasal discharge and cough), and urticaria (rash)[62]. The consequences of infection in breeding mares may be severe, with abortion or neonatal foal death reported[62]. However, EAV also ***commonly*** causes sub-clinical infections in horses[62].

Mares and geldings eliminate infection within 21 to 30 days, but 30-60% of stallions remain persistently infected[44], secreting infectious virus in their semen. Consequently, routes of infection are primarily venereal, from stallion to mare or via infected semen, but outbreaks implicating aerosol spread have been recorded[30,164]. Donkeys and zebras have been shown to have serological evidence of infection[112], and the donkey strain of EAV has been experimentally transmitted to horses[113]. Despite lateral transmission from donkeys to horses (which showed mild clinical signs), the asinine strain was not recovered from semen or transmitted venereally among horses[111], implying the possibility of host species and strain related variation in EAV infections.

Serological evidence exists for the presence of EAV in Australia since at least 1975, with the possibility of a carrier stallion entering via England, New Zealand or directly from North America since the 1950s[62]. Evidence of EAV infection is predominantly found in the Standardbred population, however other breeds, including Thoroughbreds, have also been found to have serological evidence of infection[63]. However, ***outbreaks involving clinical signs and lateral aerosol transmission have not been described in this country***. Pathogenic

differences among strains of EAV in South Africa have been recorded[113] and may account for this lack of disease among infected horses in Australia. There is evidence that new genetic variants are selected in persistently infected carrier stallions, leading to the emergence of new variants with differing virulence characteristics[8].

Currently, there appears to be only one major serotype of EAV in Australia, but introduction of other serotypes, with potential differences in virulence, could be possible with the importation of an infected "carrier" stallion or infected semen (either frozen or fresh chilled). Consequently all stallions and their semen are tested prior to importation into Australia in order to prevent the introduction of new virulent strains to this country.

5.10.3.2 "Pigeon Fever" (Corynebacterium pseudotuberculosis)

The bacteria ***Corynebacterium pseudotuberculosi****s* causes disease in horses, sheep and goats and sporadically affects other species such as cattle and humans[24,69]. In sheep and goats the bacteria causes the disease **caseous lymphadenitis** (cheesy gland), which is a common disease in Australia. In horses, two major forms of the disease are recognised; **ulcerative lymphangitis** and the chronic pectoral and ventral abscesses known as **"pigeon fever"**. Ulcerative lymphangitis occurs worldwide, including on rare occasions in Australia. However, "pigeon fever" is endemic **only** in the western USA[24]. It is possible that genetic differences in the different strains of *C. pseudotuberculosis* accounts for the variation in disease presentation in horses in different countries, as well as the fact that the organism is rarely isolated from horses in Australia, but is common in sheep and goats.

The disease "pigeon fever" (also called "pigeon chest" and "Dryland Distemper"), is being reported with increasing frequency[2,94], particularly in California, and other parts of Western and Southern USA. The pathogenesis of this particular form of the disease is not well understood, but a role of biting flies or *Culicoides* spp in the introduction of this environmental organism into the skin is thought to occur[135]. The disease is seen as large, subcutaneous abscesses, which can occur anywhere on the body, but most frequently develop in the pectoral region and along the ventral midline of the abdomen. Other signs include lameness, ventral dermatitis, weight loss, and inappetence. More rarely, abscesses of internal organs can develop, and in these cases signs of fever, weight loss, inappetence and depression are more obvious. Diagnosis of this infection involves isolation and identification of *C. pseudotuberculosis* from the abscesses.

Introduction of the equine strain causing "pigeon fever" into Australia is unlikely to have serious effects on the equine industry, although individual horses may become infected with the disease, and occasional deaths have been recorded[15]. In addition, the organism would be very difficult to eradicate once it were established, as it can survive in the environment, and is transmitted to horses by biting insects.

6. Definitions

This section contains definitions of the veterinary or scientific terms used in this manual. The definitions have been obtained from two sources; Bailliere's Comprehensive Veterinary Dictionary. Blood DC and Studdert VP eds. Bailliere Tindall, 1988; and Black's Veterinary Dictionary. 13th Edition. G West ed. Adam & Charles Black, London. 1979. At times minor modifications of these definitions have been made, to place them in the context of this manual.

acute refers to the early stages of a disease, which often has severe signs and a short course of 12 to 24 hours.

aetiology the cause of a disease, or the study of causes of diseases.

Amies Charcoal specific medium which is required for the growth and diagnosis of *Taylorella equigenitalis*, the causative agent of Contagious Equine Metritis.

amplifying Host host (animal or insect) in which an organism (usually a virus) multiplies to large numbers. These are important as they are potentially a source of large numbers of a viral pathogen.

anaemia a reduction below normal of the number or volume of red blood cells (RBC) or the quantity of haemoglobin within the blood. Anaemic horses may have pale mucous membranes, be weak, have exercise intolerance and a fast heart rate.

anaphylaxis an unusual or exaggerated allergic reaction of a horse to a foreign protein or other substances. Anaphylaxis may be localised (usually involving the skin and seen as hives) or generalised.

anorexia lack or loss of appetite for food.

anterior situated at, or directed towards, the front; opposite of posterior.

antibody protective molecule produced by a horse in response to the presence of a foreign substance, e.g. a virus, bacteria or protozoa. Measurement of specific antibodies in the horse's blood (serum) can be used to demonstrate its exposure to an organism, and may be used to diagnose diseases (see serological tests).

antigen substance or organism which may be recognised by the body as being foreign to it. Examples of antigens include viruses, bacteria and protozoa.

Arthropod member of the phylum ARTHROPODA; which includes arachnids (spiders), crustaceans, and insects.

ataxia a loss of power governing movements, although the necessary power for these movements is still present. A staggering gait results. Ataxia is a symptom which may be observed in many diverse conditions e.g. general weakness or exhaustion; encephalitis; meningitis; a brain tumour.

atrophy a decrease in size of a normally developed organ or tissue; wasting. For example, atrophy of the muscles supplied by a nerve may take place following paralysis of the (motor) nerve, as the muscles are no longer able to contract.

bacteria single celled micro-organisms (prokaryotes); some bacteria cause disease (bacterial pathogen)

biotype a group of individuals (e.g. bacteria or virus) having the same genotype (genetic make-up). Different biotypes within a species have different physiological or physical characteristics and this may affect the ability to cause disease (virulence).

blood Smear a method used to examine the cells within the blood. Parasites living in the blood stream may be detected using this technique (e.g. *Babesia* spp, Trypanosomes).

brainstem the part of the brain that connects the cerebral hemispheres with the spinal cord. It includes the pons, medulla oblongata and midbrain.

cardiac pertaining to the heart.

carrier is an animal that has an organism capable of causing disease in its body, but does not show signs (symptoms) of disease. It thus acts as a carrier or distributor of infection. A true carrier is one with a latent infection and which appears healthy. Other types of carriers are the incubatory carrier, when the animal is not yet showing clinical signs, or a convalescent carrier, when it has passed the clinical stage.

chronic a disease or sign of disease which persists for a long time; the period is undefined and varies with circumstances but is usually more than one week. A chronic disease usually shows little change or very slow progression over a long period.

clinical signs the abnormalities of structure or function observed in the patient by the veterinarian or the client. These are often graded according to severity e.g. severe, moderate, mild and according to speed and onset of progress e.g. peracute, acute , subacute, chronic, intermittent.

colic a vague term applied to symptoms of abdominal pain, especially in horses. There are a large number of different conditions which may produce abdominal pain.

conjunctiva is the membrane which covers the front of the eye. It lines the insides of the eye-lids of all animals, both upper and lower, and from each of these places it is reflected on to the front of the eyeball.

contagious capable of being transmitted from animal to animal.

cross immunity a form of immunity in which immunity to one bacteria or virus is effective in protecting the animal against an antigenically similar but different organism (e.g. different strain or type of organism)

Culicoides a large genus of biting midges. They act as vectors for African horse sickness virus, equine encephalosis virus, and possibly some strains of *Corynebacterium pseudotuberculosis.*

culture the propagation of micro-organisms in special media conducive to their growth.

culture medium the substance in or upon which bacteria and other pathogenic organisms are grown in the laboratory.

decontamination the freeing of a patient or an object of some contamination such as an infectious organism.

diagnosis a name given to a disease so that each veterinarian means the same syndrome as every other veterinarian. It is then possible to prescribe for, and make a prognosis about, any one case on the basis of the outcomes in a series of animals with the same diagnosis. A diagnosis may be the name of a disease with a specific aetiology, or it may only be a description of the morphological identity of the disease, such as a patho-anatomical diagnosis, or diagnosis based on a single clinical sign.

differential d. the determination, or list, of several diseases that produce the signs observed.

disease traditionally defined as a finite abnormality of structure or function with an identifiable pathological or clinicopathological basis, and with a recognisable syndrome of clinical signs. This definition has since been widened to embrace subclinical diseases in which there is no tangible clinical syndrome but which are identifiable by chemical, haematological, biophysical, microbiological or immunological means.

emerging d. a disease that is increasing in prevalence. The disease may be newly recognised, or it may have been present for a long time, but its prevalence is currently increasing.

exotic d. a disease that does not occur in the subject country. Exotic diseases are infectious diseases that may be introduced.

disinfectant freeing from infection. An agent that destroys infection-producing organisms. Heat may be a disinfectant, but in common usage the term is reserved for chemical substances. Disinfectants are usually applied to inanimate objects since they are too strong to be used on living tissue.

disinfection the act of disinfecting.

Ehrlichia a genus of the order Rickettsiales. These organisms are intracellular parasites found within white blood cells.

ehrlichiosis the disease caused by infection with a rickettsial agent in the genus *Ehrlichia*.

encephalitides plural of encephalitis

encephalitis inflammation of the brain. A majority of the encephalitides are caused by viruses. Clinical signs of encephalitis are characterised by initial signs of nervous irritation including muscle tremors, excitement and convulsions, followed by a stage of loss of function characterised by weakness, paralysis, coma and death. Many encephalitides are accompanied by involvement of the spinal cord, and are more correctly classified encephalomyelitis.

encephalomyelitis inflammation of both the brain (encephalitis) and spinal cord (myelitis). The pathogenesis and clinical picture are similar to those of encephalitis. Many of the causes are viral, as they are for encephalitis.

endemic a disease of low morbidity that is constantly present in an animal population, but clinically recognisable in only a few. See also enzootic.

endometritis inflammation of the endometrium. The endometrium is the mucuous membrane lining the uterus (womb).

enzootic peculiar to, or constantly in, a location. Used synonymously with endemic.

epidemic attacking many subjects in a region at the same time; widely diffused and rapidly spreading. This term also refers to a disease of high morbidity, which is only occasionally present in the community.

epizootic is a term applied to a disease which affects a large number of animals in a large area of land at the same time and spreads with great rapidity. Used synonymously with epidemic.

equidae a family of mammals, members of which have a single functional digit although the second and third digits persist as splint bones. Includes horses, wild horses, asses (donkeys), and zebras.

equine pertaining to, characteristic of, or derived from the horse.

faeces manure. Body waste discharged from the intestine.

fatal causing death; mortal; lethal.

fatality rate the percentage of infected animals which die due to the presence of a specific disease causing organism.

fomite an inanimate object that is contaminated with the disease-causing micro-organisms. Fomites may be too small to see, or they may be large objects such as feed buckets, water containers, contaminated clothing or riding equipment. Faeces and bedding may act as a fomite.

genital pertaining to reproduction, or the reproductive organs, especially the external genital organs, e.g. vagina or penis.

genotype this can mean the entire array of genes carried by an individual; or the genetic constitution of an individual with respect to any limited number of genes under examination; or (more loosely) the individual within a given genotype. Alternatively it can mean the type species of a genus.

gluteal pertaining to the buttocks. The gluteal muscles are the three muscles that extend, abduct and rotate the thigh.

gold standard the best standard by which a diagnostic test is judged.

haematophagous subsisting on blood.

host an animal or plant that harbours and provides sustenance for another organism (the parasite).

- **aberrant h.** not a normal or usual host for an organism (usually a parasite). Disease is common in aberrant hosts.
- **dead end h.** host that cannot continue a life cycle for an organism, commonly a parasite.
- **definitive h.** the host in which the infectious agent in question is found as an adult, and undergoes the sexual stage of its reproduction.
- **intermediate h.** the organism in which a parasite passes its larval or non-sexual existence.
- **reservoir h.** an animal (or species) that is infected by a parasite, and which serves as a source of infection for another species (e.g horse). Disease is uncommon in reservoir hosts.

hyperaesthesia a state of abnormally increased sensitivity to stimuli.

hyperexcitable excessive mental and physical activity.

immunity the condition of being immune; security against a particular disease; non-susceptibility to the invasive or pathogenic effects of micro-organisms or helminth parasites.

partial i. the condition of being incompletely immune.

immunoperoxidase a technique of histological staining that provides morphological details and immunological identification.

inappetence partial lack of appetite or desire to eat. Presence is inferred in horses which have depressed food intake.

incubation period the interval of time required for development; especially the time between invasion of the body by a pathogenic organism and appearance of the first signs of disease. Incubation periods vary from a few days to several years, depending on the causative organism and type of disease.

incursion introduction of a disease to a country

infection invasion and multiplication of micro-organisms in body tissues.

acute i. short duration, of the order of several days.

chronic i. long duration, of the order of weeks or months.

latent i. the animal is infected, but there are no clinical signs nor infectious agent detectable in discharges.

subclinical i. infection of an individual associated with no detectable signs, but caused by micro-organisms capable of producing disease in other individuals; it is detected by the production of antibody.

infective infectious, capable of producing infection; pertaining to or characterised by the presence of pathogens

i. period period of time that a host (e.g. horse) is capable of transmitting the infectious organism to another host.

infertility the inability to conceive and produce viable offspring.

intra-uterine within the uterus (womb).

jaundice yellowness of the skin, sclerae, mucous membranes, and excretions. Also called “icterus”. Jaundice is usully first noted in the sclera.

latent(ly) not manifest, dormant or concealed. See also latent infection.

lethargy a condition of drowsiness or indifference

leucopaenia reduction in the number of leucocytes (white blood cells) in the blood. It is a common manifestation of a number of diseases, especially those caused by viruses.

life cycle a succession or recurring series of event. Usually describes the various stages of a parasite, and the hosts in which the parasite stages are found.

media materials used as substrates on which to culture microbiological agents.

metritis inflammation of the uterus (womb)

morbidity the condition of being diseased.

m. rate the ratio of diseased to healthy animals in the population.

mortality the quality of being mortal. Death as a statistic.

m. rate the death rate; the ratio of the total number of deaths to the total number of the population.

mucous membrane the membrane that lines many of the hollow organs, the air passages, the whole of the alimentary canal, the urinary passages and the genital passages.

myelitis inflammation of the spinal cord. See encephalomyelitis.

nasopharyngeal pertaining to the nasal and pharyngeal cavities.

neurological pertaining to, or emanating, from the nervous system.

oedema an abnormal accumulation of fluid in the cavities and intercellular spaces of the body. Oedema can be caused by a variety of factors, including low blood protein (hypoproteinaemia), poor lymphatic drainage, or damage to the blood vessels (increased capillary permeability).

paralysis loss or impairment of motor function in a part of the body due to a lesion of the neural or muscular mechanism. Usually means loss of muscular action due to interference with the nervous system.

parasite an animal (or plant) that lives upon or within another living organism and at whose expense it obtains some advantage. Among the many parasites in nature, some feed upon animal hosts, causing diseases ranging from the mildly annoying to the severe, and often fatal. Parasites included multi-celled and single-celled animals, fungi and bacteria. Viruses are sometimes considered to be parasites. However, the commonest use of the word refers to multi-celled helminths, arachnids, and arthropod parasites.

paresis	slight or incomplete paralysis.
pathogen	any disease producing agent micro-organism (e.g bacteria, virus or protozoa)
pathogenic	capable of causing disease e.g. bacteria, fungi, protozoa.
petechia	a minute, pinpoint, non-raised, round, purplish red spot caused by intradermal (within the skin) or submucous haemorrhage (bleeding). Petechiae is the plural form.
post mortem	performed or occurring after death. Usually refers to the procedure (examination) of dissection of a carcass with the objective of deciding the cause of death. Also called an autopsy or necropsy examination.
prepuce	an invagination of skin which covers the free portion of the penis. Also called the sheath.
protozoa(l)	a phylum comprising uni-cellular eukaryotic organisms; most are free-living but some live parasitic lives (most of the pathogens).
pulmonary	pertaining to the lungs.
purulent	containing or forming pus.
rabid	affected by rabies.
recumbency	a clinical term that is used to describe an animal that is lying down and unable to rise. Recumbent.
reservoir	an alternative host or passive carrier of a pathogenic organism. See also reservoir host.
serological	pertaining to, or emanating from serology.
serology	the conduct of tests to detect antibody, or antigen, in vitro. The detection usually involves antigen-antibody reactions. Serological tests are used for the diagnosis of many infectious diseases.
serous	pertaining to serum; thin and watery, like serum.
serum	the clear portion of any animal or plant fluid that remains after the solid elements have been separated out. The term usually refers to blood serum, the clear, straw- coloured liquid portion of the plasma that does not contain fibrinogen or blood cells, and remains fluid after clotting of blood.
speculum	an instrument for opening or distending a body orifice or cavity to permit visual inspection.

sporocyst any cyst or sack containing spores or reproductive cells. May be found within body tissues e.g. muscle.

strain one or more organisms within a species or variety, characterised by some particular quality.

subacute somewhat acute; between acute and chronic; of the order of a week's duration.

subclinical(ly) without clinical manifestations; said of the early stages or a very mild form of a disease; e.g. subclinical disease, infection, parasitism.

supraorbital fossa above the orbit (eye).

swab a small, slender wooden stick with cotton or gauze wrapped around the end and used to obtain specimens and secretions from body surfaces and orifices.

sylvatic cycle occurring in animals of the forest. Sylvatic rabies – that form of the disease transmitted by forest-dwelling animals, particularly foxes, racoons and wolves.

thrombocytopaenia decrease in the number of platelets in circulating blood. Platelets are cells within the blood stream that are required for blood to clot.

tick a blood sucking arachnid parasite. Ticks can transmit a number of important diseases, including *equine babesiosis*.

tissue cyst a cyst is a stage in the life cycle of certain parasites, during which they are enveloped in a protective wall. A tissue cyst is a cyst that occurs in any tissue the body of the host, but frequently occurs in muscles.

transmissible said of a disease capable of being transmitted from one animal to another.

transmission transfer of a disease from one animal to another

- **airborne t.** spread of infection by droplets or dust through the air. Without the intervention of winds or draughts, the distance over which airborne infection takes place is short (up to 8 metres if assisted by coughing). However, with assistance of winds, this distance can increase dramatically.
- **arthropod t.** by insect, either ***mechanically*** via contaminated proboscis (mouth parts) or feet; or ***biologically*** when there is growth or replication of the organism in the arthropod.
- **direct t.** transfer as of a disease causing agent directly from one animal (e.g. horse) to another.

urethral fossa the urethra is the tubular passage through which urine is discharged from the bladder to the exterior. The urethral fossa is the indentation found at the end of the horse's penis and which contains the distal most portion (end) of the urethra.

vaccine a suspension of attenuated or killed micro-organisms or parts of the micro-organism (viruses, bacteria or rickettsia), administered for the prevention, amelioration or treatment of infectious diseases.

vagina the canal in the female from the external genitalia (vulva) to the cervix of the uterus (womb).

vector a carrier; especially the animal (usually an arthropod) which transfers an infective agent from one host to another. For example a tick may be act as a vector by carrying babesia parasites from horse to horse. Many disease-causing agents have a required part of their life-cycle in arthropod vectors.

vesicle a small circumscribed elevation of the epidermis (skin) containing a serous fluid; a small blister.

vesicular disease a group of diseases of cloven-footed animals of major importance because of their high infectivity. These diseases include foot-and-mouth disease, vesicular stomatitis, vesicular exanthema and swine vesicular disease. Of these diseases, only vesicular stomatitis affects horses.

virulent the degree of pathogenicity of a micro-organism as indicated by case fatality rates and/or its ability to invade the tissues of the host; the competence of any infectious agent to produce pathological effects.

virus any member of a unique class of infectious agents, which were originally distinguished for their smallness and their inability to replicate outside of a living host cell. Viruses are now characterised by their simple organisation and their unique mode of replication.

virus isolation isolation of a virus, usually as a means of determining a diagnosis.

zoonosis disease of animals transmissible to humans (= **zoonotic disease**).

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8. Web Sites

Rural Industries Research and Development Corporation
http://www.rirdc.gov.au

> **RIRDC Equine Research and Development Program**
> The website of RIRDC Equine Research and Development Program
> http://www.usyd.edu.au/su/rirdc/

University of Sydney Veterinary Faculty and VEIN
The University of Sydney Veterinary Faculty and the Veterinary Education and Information Network (VEIN)
http://www.usyd.edu.au/vetfac/
http://www.library.usyd.edu.au/VEIN/

Animal Health Australia (AHA)
http://www.aahc.com.au

> **Emergency Animal Disease Preparedness (AHA)**
> http://www.aahc.com.au/preparedness/
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> **National Animal Health Information System (AHA)**
> http://www.aahc.com.au/status/
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> **Animal Disease Surveillance (AHA)**
> http://www.aahc.com.au/surveillance/
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> **Australia's Animal Health Status (AHA)**
> http:///www.aahc.com.au/status/

Agriculture Fisheries and Forestry Australia (AFFA)
http://www.affa.gov.au

Australian Animal Health Laboratory (AAHL)
http://www.csiro.au/aahl

Australian Quarantine and Inspection Service (AQIS)
http://www.affa.gov.au

Australian Veterinary Association (AVA)
http://www.ava.com.au

Australian Horse Industry Council
http://www.horsecouncil.org.au
Office International des Epizooties (OIE)
http://www.oie.int

US Animal and Plant Health Inspection Service (APHIS)
http://www.aphis.usda.gov

APHIS – Veterinary Services – Centre for Animal Health Monitoring – Equine
http://www.aphis.usda.gov/vs/horses.htm

US Department of Agriculture (USDA)
http://www.usda.gov

Plum Island Animal Disease Centre (Exotic Disease Centre)
http://www.ars.usda.gov/plum/

ProMed
Reports on Occurrence of Infectious Diseases around the world, particularly those with zoonotic potential (spread to humans).
http://www.promedmail.org

Animal Health Trust
Organisation in the UK which plays a role in monitoring infectious diseases of horses.
http://www.aht.org.uk

Horserace Betting Levy Board
Website includes Codes of Practice recommended for a number of equine venereal diseases included CEM, EVA, EHV-1 abortion, as well as Codes of Practice for Strangles, Isolation and Transportation
http://www.hblb.org.uk