Biosecurity risk assessment: Guinea pigs (*Cavia porcellus*) from Australia

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Ministry for Primary Industries
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Biosecurity risk assessment: Guinea pigs (*Cavia porcellus*)
from Australia
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Approved for Public Consultation

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Executive Summary

This qualitative risk assessment examines the biosecurity risks involved with the importation of guinea pigs from Australia. An extensive preliminary list of organisms associated with guinea pigs was compiled from several sources including a world authority on guinea pig diseases, standard text books, electronic data bases, and related MPI risk analyses. Organisms that met the following criteria were excluded from further consideration:

- Organisms that do not occur in Australia
- Organisms that already occur in New Zealand
- Organisms that are non-contagious opportunistic pathogens
- Organisms that are non-pathogenic or of low pathogenicity causing trivial diseases that are of no consequence.

As a result of individual risk assessments, weed seeds were classified as risks in the commodity and risk management options suggested include:

- Careful inspection on the day of export to ensure the guinea pigs are free from contamination with weeds and weed seeds, combined with an owner's declaration that they have been fed on a high quality diet not including weed seeds for the past 3 days.
- Quarantine for 3 days with access to only high quality hay (without seeds), fresh fruit and vegetables or processed pellets.
- Housing in cages with wire mesh floors whilst in quarantine.

1. Introduction

The last importation of guinea pigs from Australia occurred in 2000 after which the Import Health Standard (IHS) for guinea pigs was withdrawn by MPI. In 2005 a request was made on behalf of "many hundreds of Cavy (Guinea Pig) fanciers and their clubs throughout New Zealand" to again allow the importation of guinea pigs. A draft risk analysis was written by an independent consultant[1] and submitted to MPI. That document served as the basis for this risk analysis, which will be the technical basis supporting the development of a new Import Health Standard.

2. Scope

This qualitative risk assessment is limited to the risks associated with infectious and parasitic disease-causing organisms. Other risk factors that may be of commercial importance to importers (e.g. genetic diseases) are not biosecurity risks and are not part of this risk analysis. Measures that may be required to manage these risks are the responsibility of importers.

3. Commodity definition

The commodity is clinically healthy guinea pigs (*Cavia porcellus*) that were born and continuously resident in Australia.

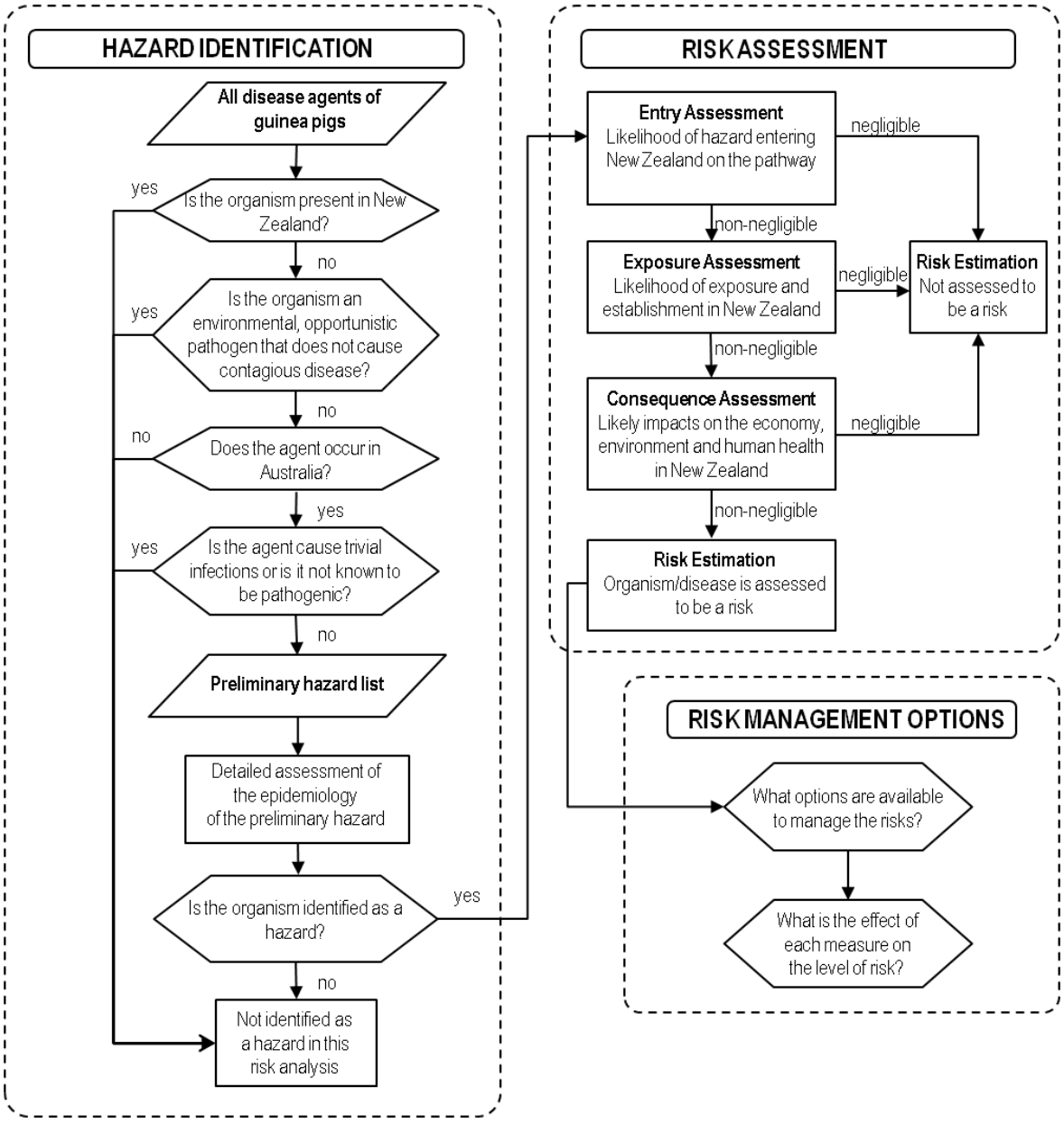
[1] Ann Ramus, Science Technology Consultants, 6809 River Road Tampa, FL 3361 5-2848, USA, with peer review by Krista Krey, Heather O'Neill, Neil Christensen, and John Harkness

4. Risk assessment methodology

The methodology used in document follows the guidelines as described in *Import Risk Analysis: Animals and Animal Products*[2] and in the relevant section of the World Organisation for Animal Health (OIE) *Terrestrial Animal Health Code* 2009, hereafter referred to as the *Code.*

The process used by MPI is summarised in Figure 1.

Figure 1 The risk analysis process



[2] Import risk analysis projects which have commenced after 12 April 2006 follow guidelines described in *Biosecurity New Zealand Risk Analysis Procedures – Verison 1.* See www.biosecurity.govt.nz/files/pests-diseases/surveillance-review/risk-analysis-procedures.pdf.

4.1. PRELIMINARY HAZARD LIST

Using authoritative texts, electronic data bases and organisms identified as significant by appropriate experts, an extensive list of organisms known to infect guinea pigs is assembled. Organisms of concern are identified by applying specific criteria to identify and eliminate those that are clearly not hazards. Organisms of concern constitute the preliminary hazard list, and the organisms on that list are subjected to more detailed examination.

4.2. HAZARD IDENTIFICATION

Each organism in the preliminary hazard list is subjected to a hazard identification step that includes formal identification of the organism, evidence of whether it is an OIE listed disease, its New Zealand status, the epidemiology of the organism in the animal species included in the commodity definition, and relevant characteristics of the disease it causes in susceptible species. The hazard identification section is concluded by an assessment of whether the organism is identified as a hazard in the commodity or not. All hazards are subjected to individual risk assessments.

4.3. RISK ASSESSMENT

Risk assessment consists of:

Entry assessment: The likelihood of a hazard being imported with the animal.

Exposure assessment: The likelihood of animals or humans in New Zealand being exposed to the hazard.

Consequence assessment: The consequences of entry, establishment or spread of a hazard.

Risk estimation: An estimation of the risk posed by the hazard based on the entry, exposure and consequence assessments. If the risk estimate is non-negligible, then the hazard is assessed to be a risk and risk management measures are justified.

Not all of the above steps may be necessary in all risk assessments. The OIE methodology makes it clear that if the likelihood of entry is negligible for a certain hazard, then the risk estimate is automatically negligible and the remaining steps of the risk assessment need not be carried out. The same situation arises when the likelihood of entry is non-negligible but the exposure assessment concludes that the likelihood of exposure to susceptible species in the importing country is negligible, or when both entry and exposure are non-negligible but the consequences of introduction are concluded to be negligible.

4.4. RISK MANAGEMENT

For each organism assessed to be a risk, a risk management step is carried out, which identifies the options available for managing the risk. Where the *Code* lists recommendations for the management of a hazard, these are described alongside options of similar, lesser or greater stringency where available. In addition to the options presented, unrestricted entry or prohibition may also be considered for all risks. Recommendations for

the appropriate sanitary measures to achieve the effective management of risks are not made in this document. These will be determined when an IHS is drafted.

As obliged under Article 3.1 of the World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures (the WTO SPS Agreement), the measures adopted in IHSs will be based on international standards, guidelines and recommendations where they exist, except as otherwise provided for under Article 3.3 (where measures providing a higher level of protection than international standards can be applied if there is scientific justification, or if there is a level of protection that the member country considers is more appropriate following a risk assessment).

4.5. RISK COMMUNICATION

After an import risk analysis has been written, MPI analyses the options available and proposes draft measures for the effective management of identified risks. These are then presented in a draft IHS that is released together with a risk management proposal that summarises the options analysis, the rationale for the proposed measures and a link to the draft risk analysis. The package of documents is released for a six-week period of stakeholder consultation. Stakeholder submissions in relation to these documents are reviewed before a final IHS is issued.

5. Developing the preliminary hazard list

The first step in the risk analysis is the identification of agents of concern and the collation of these agents into a preliminary hazard list of organisms that might be associated with guinea pigs.

5.1. ORGANISMS ASSOCIATED WITH GUINEA PIGS

The starting point for the preliminary hazard list was an extensive list of organisms of guinea pigs supplied by Dr John Harkness, an international authority on laboratory animal diseases. Dr Harkness' list is given below:

5.1.1. Bacterial Infections

Gram positive

Streptococcus zooepidemicus - Lancefield's Group C, beta haemolysis, lymphadenitis, other organs, uncommon, mastitis

S. pneumoniae - capsular types 4 and 19, uncommon, fibrinopurulent pneumonia

Staphylococcus aureus - common, pododermatitis, exfoliative dermatitis, inapparent infections also, conjunctivitis

Corynebacterium pyogenes - rare, septicaemia

Clostridium perfringens, type A - *typhlitis*, rare

C. perfringens, type E - rare, enterotoxemia in "germ free" animals

C. piliforme - Tyzzers disease, enteritis uncommon in young

C. difficile - enterotoxemia follows antibiotic administration but some spontaneous cases

Listeria monocytogenes single reference, 1955, related to rabbit case

Gram negative

Coxiella burnetii – zoonotic organism, reported in almost all species of domestic animals

Salmonella typhimurium - zoonotic potential, rare to common, may be inapparent

S. enteritidis - common with poor management

S. dublin - caused fatalities one case

S. linete - rare

S. bledgam - rare

S. moscow - rare

S. Amersfoort - rare

S. marashio - rare

S. glostrup - rare

S. poona - rare

S. weltevreden - rare

Yersinia pseudotuberculosis - rare, often inapparent, lymphadenitis, ileitis and cecitis

Bordetella bronchiseptica - common respiratory pathogen, interspecies spread

Klebsiella pneumoniae - rare, bronchopneumonia to septicemias, mastitis

Pasteurella multocida - rare, conjunctivitis, septicemia, pneumonia

Pseudomonas aeruginosa - rare, pulmonary botryomycosis (lungs)

Leptospira icterohemorrhagiae - rare, one case, 1973

Lawsonia intracellularis - uncommon duodenal hyperplasia following steroid administration, diarrhoea in spontaneous Asian outbreak

Streptobacillus moniliformis - rare, from abscesses, pneumonia

Brucella abortus - rare, only three reports for *Brucella*

B. melitensis - rare

B. suis - rare

Escherichia coli - carriers develop colibacillosis following administration of some antibiotics, mastitis, uncommon

Selenomonas ruminantium - motile bacterium with flagella, three reports, Brazil and North America, low pathogenicity

Chlamydia

Chlamydophila caviae - common, causes conjunctivitis (GPIC), young affected, intracytoplasmic inclusions

Other

Mycoplasma pulmonis – from mice, rare, few isolations

M. caviae - rare, recovered from single group of guinea pigs 1971

Mycobacterium bovis – rare, 1958

M. tuberculosis - rare, one case, 1953

5.1.2. Mycotic Infections

Dermatophytes

Trichophyton mentagrophytes - common, skin lesions, often asymptomatic, public health concern

Microsporum canis - uncommon

Systemic mycoses

Histoplasma capsulatum - rare, reported Brazil 1967

Cryptococcus neoformans - rare, perhaps one report (1923)

Candida albicans - rare, reported 1948

Enteric resident

Sphaeromonas communis - normal gut flora

5.1.3. Parasitic Infestations

Ectoparasites

Mites

Trixacarus caviae - worldwide, dermatitis, pruritus

Chirodiscoides caviae - common, few signs of dermatitis

Demodex caviae - rare

Myocoptes musculinus - rare, one reference (1960)

Notoedres muris - rare two reports, from rabbits

Sarcoptes scabiei - rare

Lice

Gliricola porcelli - most common, asymptomatic or dermatitis

Gyropus ovalus - uncommon, some signs

Trimenopon hispidium - rare

Endoparasites

Protozoa

Cryptosporidium wrairi - small intestine, diarrhoea or no signs, common USA

Eimeria caviae - common worldwide, diarrhoea, large intestine

Klossiella cobayae (renal) - common Europe, USA, South American, Africa

Encephalitozoon cuniculi - worldwide, uncommon in guinea pigs

Toxoplasma gondii - Americas and Europe, uncommon, public health concern

Leucocytozoon caviae - Malaysia, 1908

Trypanosoma brucei - Africa, 1932

Trypanosoma omsi - South America, rare

Leishmania enrietti - from farmed guinea pigs

Sarcocystis caviae - subclinical, rare

Giardia duodenalis - possible zoonotic risk, worldwide, rare enteritis

Tritrichomonas caviae - common worldwide

Endolimax caviae - uncommon, USA, Asia, Europe

Entamoeba caviae - common USA, Europe, South America

Chilomitus caviae - probably common, worldwide

Chilomitus conexus - rare occurrence

Hexamastix caviae - uncommon, worldwide

Hexamastix robustus - uncommon

Monocercomonas caviae - USA, Europe, Brazil, uncommon

Monocercomonas pistillum - rare in USA

Monocercomonas minuta - rare in USA

Chilomastix intestinalis - may be common worldwide

Chilomastix wenrichi - uncommon, reported only in USA

Retortamonas caviae - common worldwide

Monocercomonoides caviae - common, USA, Brazil, Europe

Monocercomonoides quadrifunilis - USA occurrence

Monocercomonoides wenrichi - no details

Monocercomonoides exilis - USA occurrence

Enteromonas caviae - USA and Europe, rare

Proteromonas brevifilia - rare in Europe and USA

Colpodella edax - rare

Caviomonas mobilis - uncommon, subclinical, flagellate, USA

Oikomonas termo - free-living coprozoic, Russia, France

Balantidium caviae - worldwide, rare to common, usually no signs

Cyathodinium spp. - Worldwide, colonic endosymbionts

Cyathodinium piriforme - Brazil

Cyathodinium cunhai - Brazil

Cyathodinium chagasi - wild guinea pigs only

Kopperia intestinale - no detail, cecum

Protocaviella acuminate - rare reports, cecum

Enterophrya elongate - rare in South America

Helminths

Baylisascaris procyonis - few reports, neurologic signs

Paraspidodera uncinata - worldwide, common, benign

Fasciola spp. - South America, may be common worldwide

Pelodera strongyloides - single report, dermatitis

5.1.4. Viral Infections

DNA viruses

Adenovirus - may be common in young, respiratory tract, intranuclear inclusions

Cytomegalovirus (Herpesvirus) - inapparent, salivary glands, common

Guinea pig “Herpes-like” virus (GPHLV) - no disease, probably rare, kidney

Guinea pig “X” virus (GPXV) - from leukocytes, uncertain prevalence

Guinea pig pox-like virus (GPPLV) - one report in young, rare, fibrovascular proliferation

RNA viruses

Parainfluenza 3 viruses (PI-3 and CAV PI-3) - seroconversion common, subclinical

Pneumonia virus of mice - rare seroconversion, mouse exposure

Sendai virus (PI-1) - seroconversion, mouse exposure

Arenavirus (LCMV) - rare, public health concern, neurologic syndrome

Coronavirus-like virus - rare, wasting disease, diarrhea

Picornavirus (MEV strain GD VII) - rare seroconversion, mouse exposure

Reovirus 3 - rare seroconversion, mouse exposure

Raccoon-variant rabies virus (Lyssavirus) - rare occurrence, one report

Simian virus 5 - uncertain or rare seroconversion

Retrovirus (C-type) - rare, leukaemia association

5.2. REFINING THE LIST OF ORGANISMS

As illustrated in Figure 1, the following criteria were applied to identify agents that are not hazards:

- Disease agents that already occur in New Zealand.
- Organisms that are environmental, opportunistic pathogens that do not cause contagious diseases.
- Disease agents that do not occur in Australia.
- Agents that are of very low pathogenicity causing trivial infections or are not known to be pathogenic.

5.2.1. Bacteria

Bacteria not identified as hazards include:

- Organisms commonly identified in New Zealand as evidenced by quarterly reports from diagnostic laboratories: *Staphylococcus aureus, Arcanobacterium pyogenes* (formerly *Corynebacterium pyogenes*), *Listeria monocytogenes Yersinia pseudotuberculosis, Klebsiella pneumoniae, Pseudomonas aeruginosa, Lawsonia intracellularis, Escherichia coli*.
- Other organisms that occur in New Zealand: *Streptococcus zooepidemicus* (Julian 1992), *Streptococcus pneumoniae* (Brett *et al.* 1999), *Clostridium piliforme* (Graham 1998), *Clostridium difficile* (Briant *et al.* 2005), *Bordetella bronchiseptica* (Anonymous 1979; Shrubb 1998). *Streptobacillus moniliformis* (Sakalkale *et al.* 2007).
- Various types of *Clostridium perfringens* that are associated with a wide variety of syndromes and occur universally.

- *Mycoplasma pulmonis* occurs commonly in rats and mice (Davidson *et al.* 1994) and is assumed to be present in New Zealand. It is not generally a pathogen of guinea pigs.
- *Mycoplasma caviae* is specific for guinea pigs and is usually considered to be non-pathogenic (Hill 1971b). When the organism suspended in complete Freund's agent was injected accidentally into a human, it caused a mild local reaction that resolved spontaneously and elicited an antibody response (Hill 1971a). *Mycoplasma caviae* has also been isolated from guinea pigs but is not known to cause disease in guinea pigs (Schoeb 2010).
- *Mycobacterium bovis* does not occur in Australia and according to Harkness (2009) only one case of naturally occurring *Mycobacterium tuberculosis* has been described in guinea pigs in 1953.
- *Selenomonas ruminantium* is a normal inhabitant of the ruminal flora of ruminants and is not considered to be a pathogen.
- *Chlamydophila caviae* causes conjunctivitis in guinea pigs. It has been stated that "*Chlamydophila caviae* is markedly specific for guinea pigs, as attempts to infect mice, hamsters, rabbits and gerbils have been unsuccessful, except for one experimentally infected gerbil" (Everett *et al.* 1999). It is a common and typically self-limiting subclinical infection. If disease does occur, full recovery usually follows within 4 weeks. Treatment, if needed, (eyedrops) is widely available. Since the organism is probably universally distributed and is usually a self-limiting infection confined to guinea pigs, it is not a hazard.

5.2.2. Fungi

Fungal disease agents, except the dermatophytes, are opportunistic pathogens that exist in the environment and infected animals are not contagious. The dermatophytes mentioned in Harkness' lists are already present in New Zealand. Therefore, mycotic agents are not a hazard.

5.2.3. Viruses

All viruses listed above are not hazards:

- Guinea pig adenovirus is listed by the International Committee on Taxonomy of Viruses (ICTV) as a tentative species (Benko *et al.* 2005). The virus has not been isolated but is demonstrated by the presence of typical inclusion bodies (Benko *et al.* 2005; Missouri University College of Veterinary Medicine 2002). The morbidity, mortality and transmissibility are reported to be low (Schoeb 2010). Benko *et al.* report that the natural host range of adenovirus types is confined to one species or to closely related species (Benko *et al.* 2005). Therefore, it is concluded that the virus causes a trivial disease and is confined to guinea pigs and is not a hazard.
- Cavid herpesvirus 1 and Cavid herpesvirus 3 are unassigned viruses in the Herpesviridae. Cavid herpesvirus 2 (Guinea pig cytomegalovirus) is a species in the Genus Roseovirus (Davison *et al.* 2005). Cytomegalovirus infection is described as inapparent, and common and occurring in salivary glands and common if not ubiquitous and causing rare disease (Schoeb 2010). According to Davison *et al.*

(2005) "As a general rule, the natural host range of individual viruses is highly restricted and most herpesviruses are thought to have evolved in association with a single host species". Studies on the various herpes viruses of guinea pigs indicate that they cause the development of antibodies but do not indicate that they cause significant disease (Bia *et al.* 1979; Bia *et al.* 1980; Connelly *et al.* 1987; Hsiung *et al.* 1976; Lam and Hsiung 1973). No evidence was found to indicate that cavid herpes viruses occur in other species.

Hsuing and Schoeb consider cavid herpes-like virus to be a synonym for Cavid herpesvirus 2 (Hsiung *et al.* 1976; Schoeb 2010). No evidence was found that the virus occurs in species other than guinea pigs or that it causes significant disease. Guinea pig X virus is considered to be a synonym of Cavid herpesvirus 3. It is not known to cause disease (Schoeb 2010). No evidence was found that it infects species other than guninea pigs. Since cavid herpes viruses cause trivial diseases and are not known to infect other species the cavid herpes viruses are not hazards.

- Guinea pig pox-like virus is not listed by the International Committee on Taxonomy of Viruses as a known or tentative species within the pox viruses. Only one report was found relating to pox-like virus particles identified by electron microscopy in the muscles of guinea pigs. The virus was not isolated or formally identified (Hampton *et al.* 1968). Therefore, it is considered to be a rare curiosity finding and it is not identified as a hazard.
- Cavid parainfluenza virus 3 is a virus that has been isolated from healthy guinea pigs. Experimentally infected guinea pigs did not show signs of infection but developed antibodies to the virus (Simmons *et al.* 2002). The virus is not a significant pathogen and no evidence was found that it infects species other than guinea pigs. Therefore, it is not a hazard.
- Pneumonia virus of mice (PVM) commonly infects mice causing no disease or a mild disease of short duration, except in immunologically compromised animals (Cerberus 2003) or after serial passage of the virus in mice (Horsfall and Hahn 1940). No references were found indicating that long-term carriers of virus occur. Experimental infection of guinea pigs did not result in signs of infection (Horsfall and Hahn 1940). Mild lesions of bronchopneumonia were found in only 2 of 35 guinea pigs infected nasally with the virus. However, 25 of the animals were infected spontaneously with *Bordetella bronchseptica* during the course of the experiment (Griffith *et al.* 1997). There is no evidence that guinea pigs are maintenance hosts or long term carriers of the virus. Therefore, the virus is considered to be a virus of mice and rats and not of concern in guinea pigs. In addition, John Schofield , Director of Animal Welfare at Otago University, states that "the mouse and rat serology we have done indicates a low prevalence of both PVM and Sendai – mostly these occur in mice. We don't routinely test guinea pigs for serology" (Schofield 2010). Therefore, the virus is not a hazard.
- Sendai virus causes infection primarily in mice, but also in hamsters, rats and guinea pigs (Faisca and Desmecht 2007). Since the disease is already present in New Zealand (Schofield 2010) the virus is not a hazard.
- Lymphocytic choriomeningitis virus. The virus occurs commonly in wild mice. It has been described as occurring virtually worldwide (Southern 1996). Therefore, it

is probable that the virus already occurs in New Zealand. Information from CDC states that "While it might be possible for other animals to become infected with the virus, documented infections in humans have occurred only after exposure to infected mice and hamsters. Human infections almost always occur from house mice and rarely occur from pet hamsters". The virus is commonly transmitted by hamsters or hamster cell lines (Peters *et al.* 1996). Harkness (2009), states that the virus is rare in guinea pigs. Since the disease is rare in guinea pigs, almost certainly occurs in mice in New Zealand and is usually transmitted from mice or hamsters to humans it is not a hazard.

- Coronavirus-like virus particles were identified by electron microscopy and associated with wasting disease and diarrhoea in guinea pigs. However the virus was not isolated or formally identified (Jaax *et al.* 1990). In another study virus particles were identified in normal guinea pigs (Marshall and Doultree 1996). No other references were found to this virus occurring in guinea pigs. This limited information does not constitute grounds for considering the virus to be a hazard.
- Mice are the natural hosts of several strains of picornaviruses that cause mouse encephalomyelitis (Jacoby *et al.* 2002) . The species name of the virus is *Theiler's encephalomyelitis virus* (Stanway *et al.* 2005). Antibody to mouse encephalomyelitis virus has been described in guinea pigs and some circumstantial evidence suggested that an encephalomyelitis virus might occur in guinea pigs (Hansen *et al.* 1997). However, there has been no definitive work to demonstrate such a virus. Therefore, these viruses are assessed to be viruses of mice and are not a hazard.
- According to Harkness (2009) antibodies to Reovirus 3 have been reported rarely in guinea pigs exposed to mice. However, the ICTV does not list any reoviruses of guinea pigs or mice. Therefore, the antibody is likely to have been caused by incidental contact with unidentified reoviruses. Reoviruses are not a hazard.
- One case of rabies has been described in a guinea pig which was bitten by a rabid racoon (Wadsworth Centre 2003). This is a one-off case and the likelihood that a guinea pig destined for export to New Zealand would be bitten by a rabid animal is considered to be negligible.
- Simian virus 5 infects dogs, monkeys and humans (Lamb *et al.* 2005). Canine parainfluenza virus is considered to be closely related to or identical to Simian virus 5 (Chatziandreou *et al.* 2004; Ford 2006; Greene 2006). Since it only causes uncertain or rare seroconversion in guinea pigs (Charles River Laboratories 1989) and is probably identical to canine parainfluenza virus that occurs in New Zealand (Hill 1999) it is not a hazard.
- Guinea pig type-C oncovirus is an endogenous retrovirus found in the DNA of guinea pigs (Davis and Nayak 1977). It is therefore not an infectious virus in the normal sense and is not a hazard.

5.2.4. Protozoal infections

- *Cryptosporidium wrairi* is a parasite isolated from guinea pigs. Infections in guinea pigs are frequently subclinical. It did not infect immunodeficient mice (Chrisp *et al.* 1995) or chickens, turkeys, mice or rabbits (Vetterling *et al.* 1971). It is considered

to be a trivial species-specific disease (Missouri University College of Veterinary Medicine 2002). Since the parasite causes a mild or trivial disease and is specific to guinea pigs it is not a hazard.

- *Eimeria caviae* is usually non-pathogenic but may cause clinical signs and mortality (Taylor *et al.* 2007a). Another author described the parasite as being moderately pathogenic (Harkness *et al.* 2002). It has a worldwide distribution (Taylor *et al.* 2007a) and therefore probably already occurs in New Zealand. No references were found to it infecting species other than guinea pigs. Therefore it is not a hazard.
- *Klossiella cobayae* is a parasite of guinea pigs that has a predilection for the kidney but may be found in other organs. Clinical signs and gross necropsy signs are absent except in heavy infections (Hoffman and Hanichen 1970; Stojanov and Cvetanov 1965; Vetterling and Manning 1976). No references were found to the parasite occurring in species other than guinea pigs. It has a worldwide distribution (Taylor *et al.* 2007b) and therefore it is likely that that the parasite already occurs in New Zealand. Since the parasite causes a mild or trivial disease and is specific to guinea pigs it is not a hazard.
- *Encephalitozoon cuniculi* is primarily a parasite of rabbits and rarely found in guinea pigs. The parasite is found in New Zealand (Anonymous 1980) and it is not a hazard.
- *Toxoplasma gondii* is endemic in New Zealand and therefore not a hazard.
- Guinea pigs are susceptible to African animal trypanosomes (The Centre for Food Security and Public Health 2009) and have frequently been used for experimental investigations, but no reference was found to natural infection in guinea pigs. In South America guinea pigs are frequently infected with *Trypanosoma cruzi* (Basombrio *et al.* 1987; Vazquez *et al.* 1999). However, vectors for African trypanosomes (tsetse flies) and *Trypanosoma cruzi* (Triatomes, kissing bugs) are not present in New Zealand and none of the trypanosome species occur in Australia. Therefore, the organisms are not a hazard.
- *Leishmania enrietti* infests guinea pigs naturally (Machado *et al.* 1994). No reference was found to the parasite occurring in other species. In addition the vectors for *Leishmania* spp. (phlebotomine sandflies) are not present in New Zealand . Therefore, the parasite is not a hazard.
- *Sarcocystis* spp. have a complex life-cycle requiring a carnivorous primary host that becomes infected by eating an infected secondary host. Importing an infected guinea pig would not introduce the parasite unless the guinea pig was eaten by a competent carnivorous host. The parasitic infection in guinea pigs is described as subclinical and rare. The likelihood that the parasite could complete a complex life-cycle and become established in New Zealand is considered to be negligible. Therefore, the organism is not a hazard.
- *Giardia duodenalis* and *Giarida intestinalis* are synonyms (Taylor *et al.* 2007a). It is a common parasite of man and animals and is endemic in New Zealand (Hunt *et al.* 2000). Therefore, it is not a hazard.

- *Chilomitus caviae* and *Chilomitus conexus* commonly occurs in the caecum of guinea pigs (Griffiths 1971), but no evidence was found that they are pathogens or that they occur in other animals. Therefore, these organisms are not a hazard.
- *Tritrichomonas caviae* is a parasite that is found in the kidneys of guinea pigs. It is generally considered to be non-pathogenic and it has a world-wide distribution (Taylor *et al.* 2007e). Therefore, it is not a hazard.
- *Hexamastix caviae* and *Hexamastix robustus* occur in the caecum of guinea pigs (Griffiths 1971) but no evidence was located that they occur in other species or that they are pathogens. Therefore, they are not identified as hazards.
- *Monocercomonas caviae, Monocercomonas pistillum* and *Monocercomonas minuta* are not pathogenic (Charles River Laboratories International 2009). No evidence was located that indicates that the parasites occur in species other than guinea pigs. Therefore they are not hazards.
- *Chilomastix intestinalis* and *Chilomastix wenrichi*. Of the 29 species of this genus listed in the Tree of Life project the two species listed above are the only ones from guinea pigs (Tree of Life Web Project 2008a). There is no evidence that they are pathogenic or occur in other animals. Therefore, they are not hazards.
- *Retortamonas caviae* is the only species from guinea pigs amongst 27 species listed from this genus (Tree of Life Web Project 2008c). No evidence was found that the organism is pathogenic or occurs in species other than guinea pigs. Therefore, it is not a hazard.
- *Monocercomonoides caviae, Monocercomonoides quadrifunilis, Monocercomonoides wenrichi* and *Monocercoomonoides exilis*. No evidence was found that any species of *Monocercomonoides* spp. is pathogenic. Therefore, these organisms are not hazards.
- *Enteromonas caviae* is the only species in the genus that is from guinea pigs (Tree of Life Web Project 2008b). There is nothing to suggest that it is a pathogen or occurs in species other than guinea pigs. Therefore, it is not a hazard.
- *Proteromonas brevifilia* has been described in guinea pigs (Griffiths 1971) but no evidence was found that it is a pathogen. Therefore, it is not a hazard.
- *Colpodella edax* is a carnivorous protozoa that has been isolated from fresh water (Leander and Keeling 2004). No evidence was found to suggest that it is a pathogen. Therefore, it is not a hazard.
- *Caviomonas mobilis* has been isolated from mice (Brugerolle and Regnault 2001). No evidence was found that it is a pathogen. Therefore it is not a hazard.
- *Oikomonas termo* is a free-living protozoan that utilises bacteria as its food source (Hardin 1944). No evidence was located that suggests that the organisms is a pathogen, Therefore, it is not a hazard.
- *Balantidium caviae* may be the same organism as *Balantidium coli* (Scott 2005) or a specific parasite of guinea pigs. In either case it is not regarded as a primary pathogen (Harkness *et al.* 2002) but may be an opportunistic pathogen. *B. caviae* has a world-wide distribution and is not identified as a hazard.

- *Cyathodinium* spp. occur commonly in guinea pigs (Alves *et al.* 2007) and are found world-wide. No reports were found indicating that they are pathogens. Therefore, they are not hazards.
- No information was found in three electronic databases and available books on *Kopperia intestinale, Protocaviella acuminate* and *Enterophyra elongate*. Therefore, these organisms are assumed to be trivial non-pathogenic organisms and are not hazards.

5.2.5. Helminth infections

- *Baylisascaris procyonis* is a parasite of raccoons and rarely of dogs. Accidental infections of aberrant hosts have been described in many species of animals including humans and guinea pigs. However, in aberrant hosts the parasitic larvae penetrate the gut and migrate in tissues where they become encysted. The effects on aberrant hosts depend on which tissues are infected , when the brain is affected serious disease and death may result (Sorvillo *et al.* 2002). However, unless animal tissues containing encysted larvae are ingested by a raccoon the life-cycle of the parasite remains uncompleted. Guinea pigs are dead-end hosts and not important in the epidemiology. Therefore, *B. procyonis* is not a hazard.
- *Fasciola hepatica* occurs endemically in New Zealand. *Fasciola gigantica* occurs in tropical areas but is not present in Australia (Molloy *et al.* 2005). Therefore, these organisms are not a hazard.
- *Paraspidodera uncinata* is a common, non-pathogenic or mildly pathogenic parasite of guinea pigs that occurs world-wide (Taylor *et al.* 2007c). It has not been described in New Zealand (McKenna 2009) but is likely to be present. It is considered to be non-pathogenic or mildly parasitic and it is a specific parasite of guinea pigs. Therefore, it is not identified as a hazard.
- *Pelodora strongyloides* is a saprophytic organism found in soil and decaying vegetable material . The larvae occasionally invade the skin of humans and animals causing dermatitis (Fitzgerald *et al.* 2008; Rashmir-Raven *et al.* 2000; Saari and Nikander 2006; Yeruham and Perl 2005). Guinea pigs are rare accidental hosts of the larvae (Todd *et al.* 1982). Therefore, it is not a hazard.

5.2.6. Ectoparasites

The mites *Trixacarus caviae, Chirodiscoides caviae, Mycoptes musculinus, Notoedres muris and Sarcoptes scabiei* have all been described in New Zealand (Tenquist and Charleston 2001). *Demodex caviae* has not been described in New Zealand but is a rare, strictly species-specific parasite that usually causes subclinical infections except in immunodeficient guinea pigs (Schonfelder *et al.* 2010). The lice *Gliricola porcelli*, and *Gyropus ovalus* have been described in New Zealand (Tenquist and Charleston 2001) and *Trimenopon hispidium* is a rare parasite that is easily overlooked (Taylor *et al.* 2007d). Therefore none of the mites listed by Harkness or found in other sources are hazards.

5.3. PRELIMINARY HAZARD LIST

The exclusion of organisms in the previous section, and the addition of weed seeds in line with all imports of live animals, resulted in the following organisms being retained on the preliminary hazard list and therefore requiring individual risk assessments.

- *Brucella* spp.
- *Coxiella burnetii*
- Exotic *Leptospira* serovars
- Exotic *Salmonella* serovars
- Weed seeds

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6. Brucella *spp.*

6.1. HAZARD IDENTIFICATION

6.1.1. Aetiological agent

Brucella abortus, Brucella melitensis and *Brucella suis.*

6.1.2. OIE list

Listed.

6.1.3. New Zealand status

Listed on the unwanted organisms register as exotic unwanted organisms.

6.1.4. Epidemiology

B. abortus is a pathogen of cattle. *B. melitensis* is a pathogen of sheep and goats and *B. suis* is a pathogen of pigs. Each of the species mentioned can occasionally infect other species of mammals including humans, in which serious disease may result (Godfroid *et al.* 2004a, 2004b, 2004c). Infections in humans and several other hosts are non-contagious.

Guinea pigs are susceptible to infection and have been widely used for experimental and diagnostic purposes. However, when experimentally infected guinea pigs were kept in cages next to non-infected guinea pigs, cross contamination was not observed. Injection of cultured bacteria or infected material into guinea pigs results in septicaemia with lesions in local lymph nodes and enlarged spleens and high antibody titres, but the guinea pigs do not develop clinical disease.

Natural infections in guinea pigs are rare and only a few cases have been reported (Harkness 2009).

B. abortus and *B. melitensis* do not occur in Australia (OIE 2008) and *B. suis* occurs only in feral pigs in Queensland and in humans that have had contact with them (Godfroid 2002; Robson *et al.* 1993).

6.1.5. Hazard identification conclusion

B. abortus and *B. melitensis* do not occur in Australia so are not identified as hazards in the commodity. *B. suis* occurs in only feral pigs in Queensland. In addition infected guinea pigs are likely to be dead-end hosts and natural infections in guinea pigs are rare. The likelihood that guinea pigs that will be exported to New Zealand would have contact with feral pigs in Queensland is considered to be negligible. Therefore, *B. suis* is not identified as a hazard in the commodity.

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7. Coxiella burnetii

7.1. HAZARD IDENTIFICATION

7.1.1. Aetiological agent

Coxiella burnetii

7.1.2. OIE List

Listed.

7.1.3. New Zealand status

Notifiable unwanted organism (MAF 2008). New Zealand is free from *C. burnetii* (Worthington 2001).

7.1.4. Epidemiology

Coxiella burnetii probably infects all mammalian species, birds and many arthropods (Marin and Raoult 1999; Marrie *et al.* 1993). In animals the infections are of minimal economic importance and rarely cause disease, but it is a zoonotic organism that sometimes causes serious disease in humans. Most human infections are asymptomatic or present as a mild flu-like disease, but acute or chronic infections sometimes occur, occasionally with serious complications such as myocarditis, endocarditis, hepatitis, and renal failure (Marin and Raoult 1999; Woldehiwet 2004). Sporadic abortions occur in humans and animals (Hatchette *et al.* 2003; Marin and Raoult 1999; Raoult *et al.* 2002; Woldehiwet 2004).

Transmission commonly occurs through contact with infected uterine discharges and placentae and probably by inhalation of dust contaminated by birth products (Arricau-Bouvery and Rodolakis 2005; Behymer and Riemann 1989; Hawker *et al.* 1998; Marin and Raoult 1999; Marrie *et al.* 1993; Selvaggi *et al.* 1996; Tissot-Dupont *et al.* 1999). Infected ticks may also play a role in transmission; at least 40 species of ticks from 11 genera can be infected (Kelly 2004) and their dried faeces contaminates dust.

Infected animals generally show no clinical signs, thus making the determination of the incubation period and the interval to the development of antibodies difficult to determine. In humans the incubation period is given as 1-3 weeks and the development of detectable antibody titres takes 2-3 weeks after the onset of symptoms (Marin and Raoult 1999). It is assumed that infected guinea pigs will develop antibodies within a similar time interval after infection.

Wild rodents may be subclinically infected and may remain carriers and excrete the organism (Australian Wildlife Network 2009). While the susceptibility of guinea pigs makes them suitable for experimental and diagnostic purposes, natural infections in guinea pigs have not been described.

For diagnosis in subclinically infected wildlife species detection of antibody using an ELISA test in combination with detection of DNA in faeces by PCR is recommended

(Australian Wildlife Network 2009). Diagnosis in guinea pigs could be attempted using the same methods.

7.1.5. Hazard identification conclusion

C. burnetii is endemic in Australia, and guinea pigs are susceptible to infection. Therefore, it is concluded that *C. burnetii* is a hazard in the commodity.

7.2. RISK ASSESSMENT

7.2.1. Entry assessment

Natural infections of guinea pigs have not been reported. A wide range of animals are susceptible and the disease occurs in Australia, where cattle sheep and goats are the principal sources of infection. To become infected, guinea pigs would have to come into direct contact with birth products of infected livestock. While tick bite is another theoretical pathway, ticks have not been reported naturally on guinea pigs. Therefore, the likelihood of the organism being introduced in guinea pigs is negligible.

7.2.2. Risk estimation

Because the entry assessment is negligible, the risk estimate for *C. burnetii* is negligible and it is not assessed to be a hazard in the commodity. Therefore, risk management measures are not justified.

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8. Leptospira serovars

8.1. HAZARD IDENTIFICATION

8.1.1. Aetiological agent

There are more than 200 pathogenic *Leptospira* serovars, arranged in at least 23 serogroups (Bolin 2009). In this document serovars are written as though they are separate species e.g. *Leptospira hardjo*.

8.1.2. OIE List

Leptospirosis is a listed disease of multiple species but the *Code* does not have a chapter on the disease. In 2007 the Terrestrial Animal Health Standards Commission stated that "development of a chapter at this time is not a priority because the disease is virtually ubiquitous and international trade is not considered to increase risks to human or animal health. Rather than leave the title and no chapter in the *Code*, the commission has decided to delete the title" (OIE 2007). At the OIE General Session in May 2009, the International Committee accepted the recommendation of the Terrestrial Animal Health Standards Commission and as a result the empty chapter on leptospirosis was deleted from the *Code*.

8.1.3. New Zealand status

L. hardjo, L. pomona, L. balcanica, L. copenhageni, L. ballum and *L. tarrasovi* have been isolated from animals in New Zealand (Midwinter 1999). A single isolation of *L. australis* has been reported from a human (Thompson 1980). In humans, serological diagnosis indicates that five of the species that have been found in farm animals also infect humans, but *L. balcanica* which is associated with possums has not been diagnosed in humans (ESR 2007). Other *Leptospira* spp. are classified as "other exotic organisms" (MAF 2008).

8.1.4. Epidemiology

Leptospirosis is not a single disease but a complex of diseases caused by many different leptospires. Most serovars are adapted to a particular host species in which they may exist for long periods without causing clinical signs. Species other than the maintenance host may be more resistant to infection but if infected are more susceptible to disease. In maintenance hosts, *Leptospira* localise in the kidneys and continue to be excreted in urine for protracted periods.

The organisms are shed in urine and semen and infection can occur through mucous membranes, venereally, by mouth or through the skin, particularly through abrasions and wounds (Hunter 2004). Clinically diseased animals shed more organisms and are more important sources of infection than chronic carriers (Horsch 1989).

In accidental hosts the incubation period may be from 2-16 days and is followed by a period of bacteraemia (Hunter 2004). The disease can be diagnosed by the isolation of the organism, but because this is a difficult process it is more usually diagnosed by serological methods. A rising titre suggests a recent infection and a stable, often low level titre indicates resolution or a chronic infection. The microscopic agglutination test is the most commonly used diagnostic test and a number of variations of ELISA are also available but

generally lack serovar specificity (Bolin 2009). Leptospirosis is seldom the cause of economically serious disease in animals. It is a zoonotic disease that occasionally causes serious disease in humans (Thornley *et al.* 2002).

Leptospira spp. are sensitive to several antibiotics (Alt and Bolin 1996; Alt *et al.* 2001; Gerritsen *et al.* 1994; Gerritsen *et al.* 1993; Hodges *et al.* 1979; Murray and Hospenthal 2004; Oie *et al.* 1983). Leptospiruria has been successfully treated using streptomycin treatment (Alt *et al.* 2001; Gerritsen *et al.* 1994; Hodges *et al.* 1979). Streptomycin and penicillin have been used extensively for prophylactic treatment of live animals, semen and embryos in international trade. Streptomycin was found to be the drug of choice in pigs and tetracycline was also effective (Alt and Bolin 1996).

According to Harkness *et al.* (2002) guinea pigs that have been in contact with rodents infected with *L. icterohaemorrhagiae* may develop disease characterised by jaundice and haemorrhages in several organs. There are innumerable reports of guinea pigs being used for experimental and diagnostic work but evidence of naturally occurring disease is rare. A few references were located indicating a low level of seropositivity in guinea pig colonies (Arora and Baxi 1978/1979; Belitardo *et al.* 2000). One report indicated a high prevalence of antibody titres to *Leptospira autumnalis* in what was apparently a heavily infected animal colony (Natrajaseenivasan and Ratnam 1996). No evidence was found that guinea pigs are maintenance hosts for *Leptospira* spp.

Several *Leptospira* serovars that have not been reported in New Zealand occur in Australia (Battey *et al.* 1964; Chappel *et al.* 1992; Corney *et al.* 1996; Corney *et al.* 2008; Eymann *et al.* 2007; Smythe *et al.* 2002).

8.1.5. Hazard identification conclusion

Leptospirosis is considered by the OIE to be an unimportant disease in the international trade of animals and animal products. Although guinea pigs are susceptible to experimental infection with many *Leptospira* serovars they appear to be rarely infected under natural conditions. Further, guinea pigs are not recognised as maintenance hosts for any serovars. The likelihood that a new *Leptospira* serovar could be introduced by importing clinically healthy guinea pigs from Australia is considered to be negligible. Therefore, *Leptospira* spp. are not identified as hazards in the commodity.

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9. Exotic Salmonella serovars and phage types

9.1. HAZARD IDENTIFICATION

9.1.1. Aetiological agent

There are approximately 2,500 known serovars in the *Salmonella* genus (Davies 2008). Most of these belong to the species *enterica* and the subspecies *enterica* and if correct conventions are used, the names such as *Dublin* and *typhimurium*, which do not have species status, should not be italicised. The correct name for the serovar *typhimurium* is *Salmonella enterica* subsp. *enterica* serovar Typhimurium. However, in the following discussion, for the sake of simplicity names are italicised and abbreviated as though the serovar had species status e.g. *Salmonella typhimurium*.

Within many serovars there are multiple strains which can be identified by phage typing. Phage types are identified by the notation DT and a number. *Salmonella typhimurium* DT104 is of particular significance because it exhibits multiple resistance to the common mainline antibiotics and is a threat to human and animal health (Hogue *et al.* 1997; Jones *et al.* 2002). It is now widely distributed in the world.

9.1.2. OIE list

Salmonellosis is not a listed disease in the *OIE Terrestrial Animal Health Code*. However, in the OIE *Manual of Diagnostic Tests and Vaccines* Salmonellosis is included in the section "Diseases not covered by List A and List B" (Davies 2008).

9.1.3. New Zealand status

Salmonella Dublin, Salmonella abortusovis, Salmonella gallinarum, Salmonella pullorum are listed on the Unwanted Organisms Register as unwanted, notifiable organisms. While *Salmonella Arizonae, Salmonella enteritidis* DT4 , *Salmonella typhimurium* DT44 and 104 and Salmonella spp. (exotic affecting animals) are listed as unwanted "other exotic" organisms.

Salmonella spp. isolated in New Zealand from humans and animals, by all major laboratories, are identified to serovar and phage type by the Environmental Science and Research laboratory and recorded on a database (ESR 2009). That database does not contain any records of *Salmonella* spp. isolations from guinea pigs.

Salmonella typhimurium is endemic in New Zealand in both animals and humans, but DT104 has only been isolated very rarely from humans and not from livestock. It was once isolated from three dogs in a household where the owners suffered from diarrhoea after returning from an overseas visit (Julian 2002). The sporadic occurrence of *Salmonella typhimurium* DT104 in a few cases in humans and once in dogs does not suggest that it has become established in the New Zealand animal population.

9.1.4. Epidemiology

There are no recognised exotic *Salmonella* spp. that are unique to guinea pigs, but it is assumed that guinea pigs may be infected with various *Salmonella* serovars. The

Salmonellas most commonly isolated from guinea pigs are *Salmonella typhimurium* and *Salmonella enteritidis* (Harkness 2009). It is reasonable to assume that guinea pigs are able to be infected with a number of different *Salmonella* serovars.

Salmonella infection occurs mainly by the oral route particularly from faeces or food. In guinea pigs infections may be acute with the only sign of infection being high mortality. Rough hair coat, weakness, abortion, light coloured faeces and intermittent diarrhoea may be seen. Carriers shed the organism intermittently in their faeces (Harkness 2009).

Diagnosis is by isolation of the organism from faeces, blood, spleen, liver or other organs, using standard enrichment and culture methods (Davies 2008). However, since excretion may be intermittent in carrier animals repeated culture attempts are necessary. Generic PCR methods have been developed that will identify DNA from a wide variety of *Salmonella* serovars (Daum *et al.* 2002; Pathmanathan *et al.* 2003) and are available commercially (Zoologix 2009).

Salmonellosis can be treated with antibiotics but emergence of antibiotic-resistant strains is a recognised concern in all infected species (Jones *et al.* 2002).

Salmonellosis is a serious disease of guinea pigs and it has been suggested that for control of infection in a colony of guinea pigs the entire colony should be euthanized and the caging and equipment sanitised (Harkness 2009).

9.1.5. Hazard identification conclusion

Salmonella serovars are distributed world-wide. A large variety of *Salmonella* serovars and phage types are already present in New Zealand and because salmonellosis in guinea pigs is apparently not common, it is unlikely that healthy guinea pigs would introduce an exotic *Salmonella* serovar or phage type. Guinea pigs have not been implicated as playing an important role in the transmission of salmonellae to humans.

Reflecting the above, *Salmonella* spp. are not identified as a hazard.

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10. Weed seeds

10.1. HAZARD IDENTIFICATION

10.1.1. Aetiological agent

All plant seeds and plant material.

10.1.2. OIE list

Not listed.

10.1.3. New Zealand status

This section only relates to exotic plants.

10.1.4. Epidemiology

Weeds and weed seeds could be found attached to the hair of guinea pigs. Large seed heads and pieces of plant material would be easily visible and could be removed before shipment but small seeds would not be visible. It is unlikely that seeds or plant material would remain attached for long periods.

Seeds are specifically adapted to survive unfavourable environmental conditions and most will at least survive from one growing season to another. Many will survive for several years and germinate when favourable conditions occur. Most seeds are highly resistant to dehydration, particularly those from plants adapted to survival in desert or hot dry climates and most seeds retain viability better in dry conditions but some are specifically adapted to remain viable in water. *Mimosa glomerata* seeds survived 221 years in the herbarium of the Museum National d'Histoire Naturelle in Paris. *Lupinus arcticus* seeds frozen in a leemings burrow that was dated as 10,000 years old germinated within 48hours when placed in favourable conditions (Anonymous undated). Some seeds are adapted to environments subjected to periodic fires and survive or are activated by fires. Others are adapted to be dispersed by water including those adapted to salt water.

Some plants can replicate asexually and are able to be grown from cuttings, and could grow from pieces of plants introduced on animals.

Weed seeds can survive passage through animal's digestive systems and are passed out in faeces (Katovich *et al.* undated). One hundred percent of radioopaque markers were voided from the gut of 25 human subjects in 25-169 hours (Hinton *et al.* 1969). It is not known how long seeds could be retained in guinea pig's digestive tracts. However, it is unlikely to be longer than in humans.

10.1.5. Hazard identification conclusion

It is concluded that weed seed could be introduced on a guinea pig's hair or in their faeces. Therefore, weed seeds are identified as a hazard in the commodity.

10.2. RISK ASSESSMENT

10.2.1. Entry assessment

Seeds and plant material could be introduced attached to a guinea pig's hair and in faeces, Therefore, the likelihood of entry in the commodity is non-negligible

10.2.2. Exposure assessment

Weed seeds could become detached from a guinea pig's hair or released in faeces. They are generally resistant to most environmental conditions and may remain dormant until conditions are favourable for germination. Therefore, the likelihood that seeds could germinate and grow if released into a suitable environment is non-negligible.

10.2.3. Consequence assessment

As a result of the release of exotic weed seeds, new exotic invasive weeds could be introduced and become established with subsequent deleterious effects on the environment and the economy.

10.2.4. Risk estimation

Since entry, exposure, and consequence assessments are non-negligible, the risk estimate for weeds and weed seeds is non-negligible and they are classified as hazards in the commodity. Therefore, further risk management assessment could be undertaken.

10.3. RISK MANAGEMENT

The following points have been considered when drafting options to manage the risks associated with introduction of weeds and weed seeds on the commodity:

- Under normal circumstances, where guinea pigs are fed a varied diet of fresh fruit and vegetables, processed pellets and high quality hay, weed seeds would not be expected on their coat or in their intestines.
- To minimise any risk of weed seeds in faeces it would be possible to quarantine guinea pigs for 3 days where they have access to only high quality hay (without weed seeds), fresh fruit and vegetables or processed pellets.

One or a combination of the following options could be considered in order to effectively manage the risks:

Option 1.

Careful inspection on the day of export to ensure the guinea pigs are free from contamination with weeds and weed seeds, combined with an owner's declaration that they have been fed on a high quality diet not including weed seeds for the past 3 days.

Option 2.

Guinea pigs could be quarantined for 3 days where they have access to only high quality hay (without seeds), fresh fruit and vegetables or processed pellets.

While in quarantine guinea pigs could be housed in cages with wire mesh floors without bedding or, if bedding is required, wood shavings, sawdust, artificial bedding materials blankets etc could be used.

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