

Porcine reproductive and respiratory syndrome

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Contact information

If you have any requests or inquiries concerning reproduction and rights, or suggestions or recommendations, you should address these to:

AUSVETPLAN — Animal Health Australia

Executive Manager, Emergency Preparedness and Response
PO Box 5116
Braddon ACT 2612
Tel: 02 6232 5522
email: aha@animalhealthaustralia.com.au

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1

Introduction

1.1 This manual

1.1.1 Purpose

As part of AUSVETPLAN (the Australian Veterinary Emergency Plan), this response strategy contains the nationally agreed approach for the response to an incident – or suspected incident – of porcine reproductive and respiratory syndrome in Australia. It has been developed to guide decision making to ensure that a fast, efficient and effective response can be implemented consistently across Australia with minimal delay.

1.1.2 Scope

This response strategy covers PRRS caused by porcine reproductive and respiratory syndrome virus (PRRS virus).

This response strategy provides information about:

- the disease (Section 2)
- the implications for Australia, including potential pathways of introduction, social, environmental, human health and economic effects, and the critical factors for a response to the disease (Section 3)
- the agreed policy and guidelines for agencies and organisations involved in a response to an outbreak (Section 4)
- declared areas and premises classifications (Section 5)
- biosecurity controls, including quarantine and movement controls (Section 6)
- response surveillance and establishing proof of freedom (Section 7).

The key features of PRRS are described in the **Porcine reproductive and respiratory syndrome fact sheet** (Appendix 1).

1.1.3 Development

The strategies in this document for the diagnosis and management of an outbreak of PRRS are based on risk assessment. They are informed by the recommendations in the World Organisation for Animal Health (WOAH) *Terrestrial animal health code* (15.3) and the WOAH *Manual of diagnostic tests and vaccines for terrestrial animals* (3.8.6). The strategies and policy guidelines are for emergency situations and are not applicable to policies for imported animals or animal products.

This manual has been produced in accordance with the procedures described in the **AUSVETPLAN Overview**, and in consultation with Australian national, state and territory governments; the relevant livestock industries; nongovernment agencies; and public health authorities, where relevant.

In this manual, text placed in square brackets [xxx] indicates that that aspect of the manual remains unresolved or is under development; such text is not part of the official manual. The issues will be worked on by experts and relevant text included at a future date.

1.2 Other documentation

This response strategy should be read and implemented in conjunction with:

- other AUSVETPLAN documents, including the operational, enterprise and management manuals; and any relevant guidance and resource documents. The complete series of manuals is available on the Animal Health Australia website¹
- relevant nationally agreed standard operating procedures (NASOPs).² These procedures complement AUSVETPLAN and describe in detail specific actions undertaken during a response to an incident. NASOPs have been developed for use by jurisdictions during responses to emergency animal disease (EAD) incidents and emergencies
- relevant jurisdictional or industry policies, response plans, standard operating procedures and work instructions
- relevant Commonwealth and jurisdictional legislation and legal agreements (such as the Emergency Animal Disease Response Agreement – EADRA³), where applicable.

1.3 Training resources

EAD preparedness and response arrangements in Australia

The EAD Foundation Online course⁴ provides livestock producers, veterinarians, veterinary students, government personnel and emergency workers with foundation knowledge for further training in EAD preparedness and response in Australia.

1 www.animalhealthaustralia.com.au/ausvetplan

2 www.animalhealthaustralia.com.au/nationally-agreed-standard-operating-procedures

3 www.animalhealthaustralia.com.au/eadra

4 www.animalhealthaustralia.com.au/online-training-courses

2

Nature of the disease

Porcine reproductive and respiratory syndrome (PRRS) is characterised by a marked increase in late-term abortions, stillborn and weak pigs; lowered farrowing rates, severe respiratory disease and high death rates in suckling and weaned pigs; and deaths and a delayed return to oestrus among sows. However, in some herds it is asymptomatic.

2.1 Aetiology

The aetiological agent of PRRS is an RNA virus of the order Nidovirales, family Arteriviridae, genus *Arterivirus*. The virus is closely related to equine arteritis virus. There are two related but antigenically and genetically distinguishable strains of the virus: the Lelystadt virus associated with the European outbreak of the disease; and VR 2332, the prototype of strains recovered in North America and Asia.

The virus causes disease by infecting macrophages, compromising the cellular immune response and damaging mucosal surfaces.

When a new host has been infected, the virus replicates in mucosal, pulmonary or regional lymphoid macrophages. Within 12 hours, the virus reaches regional lymph nodes and is systemically distributed to mononuclear cells and tissue macrophages. Clinical signs of infection usually occur within 4–8 days of exposure.

2.2 Susceptible species

The pig (*Sus scrofa*), whether domestic or feral, is the only species known to be naturally susceptible to this disease. There is a report of faecal shedding by mallard ducks experimentally exposed to PRRS virus in drinking water, indicating that mallards are susceptible to infection with the virus (Zimmerman et al 1997).

2.2.1 Zoonotic potential

Humans are not affected by the disease.

2.3 World distribution

For the latest information on the distribution of PRRS, refer to the World Organisation for Animal Health (WOAH) World Animal Health Information Database.⁵

⁵ <https://wahis.woah.org/#/home>

2.3.1 Distribution outside Australia

PRRS was first diagnosed in Canada in 1979 (retrospectively) and spread rapidly through North America in the late 1980s. In Europe, a similar disease caused by a related, but genetically distinct, arterivirus spread rapidly during 1990–92, although serological evidence from Germany suggested the virus was present in 1988.

Other names applied to the syndrome since its emergence include:

- mystery swine disease
- blue ear; and
- swine reproductive and fertility syndrome.

Over a period of 10 years, PRRS virus entered and became endemic in most of the world's pig population. The virus is now present throughout the world, with the exceptions of Australia, New Zealand, Sweden, Switzerland, Norway and Finland. The disease has been recognised in Korea and in Japan. Retrospective analysis of sera indicated that it was present in pigs imported by Korea in 1985 and in Japan in 1988.

2.3.2 Occurrence in Australia

PRRS has never been diagnosed in Australia. In 1996, a serological survey of 875 samples from 163 herds across all states and territories showed no evidence of PRRS virus antibodies (Garner et al 1997).

2.4 Epidemiology

The PRRS virus is highly infectious. Following infection, the virus rapidly becomes systemic. The intranasal experimental infective dose is very low, with only a small number of viral particles required to initiate infection. However, spread from pig to pig or from farm to farm is less certain. Indeed, some pockets of pigs in infected herds can remain seronegative for extended periods.

The virus spreads most easily by direct contact. Transmission can be by inhalation, ingestion, coitus, needles or possibly bite wounds. Epidemiological evidence and virus tracing suggest that the virus can be spread experimentally by aerosol, but the maximum distance has not been ascertained (Lager et al 2002, Dee et al 2003; Arruda et al 2019).

Using a rigorous program of serological monitoring and strict control measures, the French held herd prevalence below 2% for nearly two-and-a-half years after PRRS virus had entered the Loire region (Le Potier et al 1997).

2.4.1 Incubation period

Experimentally, the incubation period for individual animals is 4–8 days (Geering et al 1995), but signs may take longer to emerge in a herd. For example, reproductive failure may not occur for 25 days after infection. In addition, it is hard to pick infection in an individual pig, although the disease becomes more obvious when many pigs are affected.

Exposure of mucosal surfaces to virus results in viraemia within 12 hours of challenge. Virus is shed in saliva, urine, semen and mammary secretions. Sows inoculated intranasally showed decreases in macrophage and lymphocyte numbers within three days and were ill 4–8 days after exposure (Meredith 1995).

One-week-old gnotobiotic (pathogen-free) pigs become ill 4–5 days after infection with PRRS virus. Six-month-old specific pathogen-free pigs became ill within two days of contact with infected sows (Meredith 1995).

In field outbreaks, the interval from the introduction of infected stock to the first obvious inappetence in the herd ranged from three to 37 days (Benfield et al 1999a, Meredith 1995).

Infection with the PRRS virus can also produce clinically normal but chronically infected animals for as long as 22 weeks after exposure (Christopher-Hennings et al 1995).

WOAH incubation period

For the purposes of the WOAH *Terrestrial Animal Health Code*, the incubation period for PRRS is 14 days.

2.4.2 Persistence of agent and modes of transmission

General properties

PRRS virus is most stable between pH 5.5 and pH 6.5. Virus infectivity is reduced by over 90% at a pH lower than 5 or higher than 7. In culture medium at pH 7.5, the half-life of the European strain of PRRS virus was 140 hours at 4°C, 20 hours at 21°C, 3 hours at 37°C and 6 minutes at 56°C (Bloemraad et al 1994).

The virus is also unstable in low concentrations of detergents and is rapidly inactivated by solvents such as chloroform and ether.

Environment (including windborne spread)

The virus can survive in water for 11 days but is unlikely to survive in the environment for extended periods because it cannot withstand drying and is quickly inactivated in the absence of moisture (Benfield et al 1999a).

Aerosol spread over distances of up to 20 km was once thought possible but pig-to-pig transmission, even over a distance as small as one metre, has been difficult to repeat experimentally. Although most (45%) infected herds have been within 500 metres of the postulated source, evidence suggests that the disease can move up to a kilometre from an initial outbreak (Le Potier et al 1997). A study conducted by Arruda et al assessed the evidence available in the literature on aerosol transmission of the PRRS virus, and concluded that though is evidently possible, the probability of spread over long distances is considered relatively low (Arruda et al 2019).

Live animals

PRRS is spread mostly by direct contact with infected animals. PRRS virus is highly infectious but not highly contagious. Transmission among pen mates, which are in direct contact with each other, occurs far more readily than transmission across even a small (eg one-metre) aisle. Viral excretion persists *beyond* the time when specific antibodies have developed and infection may be prolonged. The virus is shed for an extended period in saliva (42 days), urine (14 days) and semen (43 days). Using PCR, viral RNA has been detected 92 days after exposure (Christopher-Hennings et al 1995). Pigs have transmitted disease to commingled susceptible sentinel pigs 22 weeks after originally being infected. Virus has been recovered from the oropharyngeal area 157 days after experimental infection.

Pregnant sows exposed to PRRS virus can pass the virus in utero to their piglets, which are highly likely

to develop the disease and excrete virus for extended periods. Viral RNA has been demonstrated as late as 210 days after birth in the serum of pigs infected in utero (Benfield et al 1999b). Foetuses infected at about 90 days of gestation and surviving to 21 days of age may be persistently infected.

Animal products

Meat, meat products and casings, including use as animal feed

PRRS virus has been isolated from muscle and lymphoid tissue. PRRS virus can be recovered from muscle tissues 0–24 hours after slaughter but not from muscle held at 4°C for 48 hours. Virus will, however, survive in bone marrow for several weeks when stored at 4°C (Bloemraad et al 1994).

Animal byproducts

Swill and meatmeal

The transmission of PRRS virus to pigs fed infected meat has been confirmed by research commissioned by Biosecurity Australia. Twenty-four 8-week-old pigs were infected by intranasal inoculation with either a European or American strain of PRRS virus (12 pigs per group). The pigs were all viraemic at five days post-inoculation, and were slaughtered at 11 days. Virus was detected in the semimembranosus muscle from seven of the 12 infected with the European strain and from five of those infected with the American strain. The muscle was frozen until use in the feeding experiment. Five hundred grams of raw semimembranosus muscle from each experimentally infected pig was fed over a two-day period to each of two receiver pigs (48 receiver pigs). Transmission of both strains of PRRS virus via the feeding of meat was demonstrated (Martin and Steverink 2002).

Semen and embryos from live susceptible animals

Detection of PRRS virus field and vaccine strains in semen of infected intact and vasectomised boars has been documented (Rossow 1998). Virus can be recovered from semen before seroconversion and after cessation of viraemia. Except in the period soon after infection, boars excreting virus in semen are antibody positive.

Transmission of PRRS virus via artificial insemination from infected boars was suspected on epidemiological grounds for some time, and has been confirmed experimentally (Benfield et al 1999a, Gradil et al 1996).

The virus is more likely to persist in boars than in sows because it can survive in apparently immunoprivileged sites in testes and bulbourethral glands.

Biological products (eg vaccines)

The virus survives freezing in cell culture for a prolonged period and has been isolated after one month from muscle frozen at –20°C, but levels of virus decrease with cooling, hardening and freezing.

Equipment, including personal items

The role of fomites in the transmission of the PRRS virus is uncertain. However, the virus does not persist in the environment or survive on fomites under dry conditions and does not persist on equipment or other fomites beyond one day.

Arthropod vectors

It has been shown experimentally that mechanical transmission of PRRS virus from viraemic to susceptible pigs via mosquitoes (Otake et al 2002), needles and houseflies (Otake et al 2003) may occur. Mechanical spread is theoretically possible but unlikely, given the nature of the virus.

Other relevant considerations

Mallard ducks have been shown experimentally to be capable of excreting PRRS virus in their faeces, but their role in the spread of the disease in pigs is uncertain. (Zimmerman et al 1997).

A survey of rats and mice collected from pig sheds during epidemic and endemic phases of PRRS has indicated that rodents are not a reservoir for the disease (Hooper et al 1994).

2.4.3 Factors influencing transmission

PRRS can spread rapidly through intensive pig herds by direct contact, and movement of infected pigs are the major factors in transmission of the disease. Studies have shown that risk of infection increases significantly with exposure from PRRS-infected neighbouring herds; purchase of animals from herds incubating infection; and purchase of semen from boars at PRRS-infected AI centres (Mortensen et al 2002).

It is not yet known whether pigs can become chronic carriers, although the virus can be shed for extended periods in some animals, including convalescent sows.

2.5 Diagnostic criteria

2.5.1 Clinical signs

The clinical signs of PRRS vary with the strain of virus, the immune status of the herd and management factors. Infection may also be asymptomatic.

Clinical disease in a herd is a consequence of acute viraemia in individuals and transplacental transmission of virus from viraemic dams to their foetuses, which occurs most efficiently in the last third of pregnancy.

Acute infection in adults is characterised by some or all of the following:

- reduced appetite
- fever
- blotchy cutaneous hyperaemia
- laboured breathing
- premature farrowing or abortion
- death in up to 10% or more of sows
- loss of balance (ataxia), circling and falling to one side.

Affected litters show the following signs:

- stillborn pigs
- mummified pigs
- variably sized weak-born pigs
- chemosis (excessive swelling of the mucous membranes that line the eyelids and surface of the eyes), especially in animals less than three weeks old
- high pre-weaning mortality.

In weaned pigs the clinical signs are:

- loss of appetite
- lethargy
- obvious failure to thrive
- respiratory distress
- cutaneous hyperaemia
- rough hair coats.

Concurrent infection with other microorganisms and high mortality rates are evident in weaned pigs infected with PRRS virus.

In sows, the disease episode occurs in phases. The first, which lasts about two weeks, is a period of acute illness characterised by lethargy and reduced appetite. The disease spreads quickly through a herd over 7–10 days.

As sows become infected and farrow infected litters, the second, or reproductive, phase of the disease occurs as a result of the transplacental transmission of the virus. This phase is characterised by late-term reproductive failure and can last from one to four months. Pigs that survive the pregnancy and neonatal phase usually succumb to infection after weaning, although this stage may be masked or exacerbated by concurrent infection with another disease agent, such as *Haemophilus parasuis* (Glasser's disease).

Although this description of the progression of the disease implies that there is some predictability about the clinical signs evident during an outbreak, the opposite is closer to the truth. In fact, there is no single consistent feature of PRRS virus infection in pigs. Given that the Australian pig herd is naive to PRRS virus, diagnosis will rely strongly on the recovery and identification of the infective agent. Nonetheless, in the first instance, recognition of the clinical syndrome and positive serum antibodies will likely precede virus isolation.

2.5.2 Pathology

Gross lesions

PRRS virus produces a multisystemic infection in pigs, but gross lesions are usually only observed in respiratory and lymphoid tissues. Both gross and microscopic lesions are most marked in neonatal and young weaned pigs. The gross pathology observed after uncomplicated infection of PRRS virus in finishing pigs may be unremarkable (Rossow 1998).

Lungs are mottled, tan and red, and fail to collapse; the cranioventral lobes are most affected. Lymph nodes are moderately to severely enlarged and tan in colour. Those in the cervical, cranial, thoracic and inguinal regions are most obvious at postmortem.

Under field conditions, most PRRS virus infected pigs are co-infected with one or more pathogens, which complicates the diagnosis of PRRS based on pathology.

Microscopic lesions

Microscopic examination reveals moderate to severe multifocal interstitial pneumonia characterised by:

- alveolar septal infiltration by a mixed population of mononuclear cells
- hypertrophy and hyperplasia of pneumocytes (cells lining the alveoli in the lungs); and
- marked mixed inflammatory and necrotic alveolar exudate.

Lymph nodes show marked follicular hyperplasia, foci of follicular necrosis, increased numbers of tingible (stained) macrophages and karyorrhectic (fragmented) nuclear debris within follicles. For more detail, see Benfield et al (1999a).

Pathogenesis

PRRS virus gains access to its host via mucosal surfaces, after which replication occurs in local macrophages with subsequent viraemia and distribution to regional lymphoid tissues. PRRS virus has a tropism for macrophages: it has been shown that the virus replicates mainly in macrophages of the lymphoid tissues and lungs in the acute phase of infection and persists in lung macrophages (Duan et al 1997). PRRS virus antigen has been found in the resident macrophages of a variety of tissues, as well as in other cells, including muscle tissues.

2.5.3 Differential diagnosis

In the field, suspicion of PRRS is based on clinical signs of reproductive failure and high levels of neonatal mortality. Analysis of farm records will provide helpful information.

The following diseases must be considered in the differential diagnosis of PRRS:

- any cause of ill thrift (failure to thrive); and
- any cause of abortion, mummification, stillbirths or weak piglets, including
 - **Endemic**
 - » leptospirosis
 - » porcine parvovirus
 - » haemagglutinating encephalomyelitis
 - **Exotic**
 - » porcine enterovirus
 - » Aujeszky's disease
 - » classical swine fever
 - » foot-and-mouth disease.

The respiratory and postweaning form of the disease needs to be differentiated from:

- **Endemic**
 - influenza A viruses in swine
 - enzootic pneumonia
 - proliferative and necrotising pneumonia
 - *Haemophilus parasuis* infection
 - haemagglutinating encephalomyelitis virus
 - syncytial pneumonia and myocarditis
- **Exotic**
 - porcine respiratory coronavirus
 - postweaning multisystemic wasting syndrome
 - Nipah virus infection.



Laboratory testing is required to isolate the virus.

2.5.4 Laboratory tests

Samples required

Specimens from younger rather than older animals are preferred. The following specimens should be collected.

- *For virus isolation* — whole blood and also serum, lung, respiratory tract, spleen and tonsils (samples from mummified or aborted litters are unlikely to yield virus).
- *For antibody testing (serology)* — serum from 20 exposed animals in the herd.
- *For histopathology and immunohistochemistry* — a full range of tissues in neutral-buffered formalin taken from affected pigs killed immediately before autopsy and from pigs that have recently died.

Transport of specimens

Specimens should be submitted in accordance with agreed state or territory protocols. Specimens should initially be forwarded to the state or territory laboratory for appropriate analysis, and assessment of whether further analysis will be required by the CSIRO Australian Centre for Disease Preparedness (CSIRO-ACDP), Geelong.

If the state or territory laboratory deems it necessary, duplicate samples of the specimens should be forwarded to CSIRO-ACDP for emergency disease testing, after the necessary clearance has been obtained from the chief veterinary officer (CVO) of the state or territory of the suspect case, and after the CVOs of Victoria and Australia have been informed about the case and the transport of the specimens to Geelong (for the first case). Sample packaging and consignment for delivery to CSIRO-ACDP should be coordinated by the relevant state or territory laboratory.

For further information, see the **AUSVETPLAN management manual** *Laboratory preparedness*.

Packing specimens for transport

Unpreserved specimens should be chilled and forwarded unfrozen on water ice or with frozen gel packs.

2.5.5 Laboratory diagnosis

CSIRO-ACDP tests

Virus isolation

Buffy coat, serum, lung, lymph nodes, spleen and tonsils are the specimens of choice for virus isolation. The virus grows well on swine pulmonary alveolar macrophages and Marc 145 cells. Cytopathic effects are evident in 1–4 days. Perform two 7-day passages.

Serological tests

IgM can be detected within 7 days of infection and IgG can be detected within 14 days. Humoral antibody titres reach a maximum about 5–6 weeks after infection. The test used in Australia is the IDEXX Laboratories, Inc ELISA antibody assay. ACDP can also perform immunodetection on virus-infected, fixed Marc 145 cells.

Histopathology

An experimental polymerase chain reaction (PCR) is available at ACDP.

Molecular tests

A PCR test suitable for large-scale screening is available at ACDP.

Table 2.1 Laboratory tests currently available at CSIRO-ACDP for the diagnosis of PRRS

Test	Specimen required	Test detects	Time taken to obtain result
Virus isolation	buffy coat, serum, lung, lymph nodes, spleen, tonsils	virus	3 days
IDEXX serum ELISA test	serum of EDTA blood	antibody	1 day
Immunohistochemistry	full range of tissues in neutral buffered formalin	viral antigen	2 days
PCR	lung	viral RNA	2 days

Source: Information provided by then CSIRO-AAHL, 2003. Refer to CSIRO-ACDP for most up-to-date information.

2.6 Resistance and immunity

Innate and passive immunity

Seropositive sows transmit antibodies to their offspring via the colostrum. Passive immunity appears to decline and gives way to infection soon after weaning, but the age at which pigs seroconvert is variable and in some herds pigs as old as 12 weeks are still seronegative.

Active immunity

The large variation in clinical signs is usually caused by variations in the virulence of different strains of the virus, rather than in the immune status of the pig population. Pigs infected with PRRS virus

show an immune response, which is easily detected by the presence of serum antibodies, within 7–14 days after infection. ELISA antibody titres reach maximal levels after 30–50 days and then decline to low or non-detectable levels after 4–6 months. Animals that recover are immune and protected from subsequent infection with the same serotype. Cross-protection decreases as the differences between serotypes increase. However, even in an infected herd where some older, previously infected sows may be seronegative, seropositive pigs are present in other age groups.

In an infected herd, the proportion of pigs that give a positive ELISA test is high. In herds where susceptible and infected animals are mixed, a large proportion (80–100%) of the pigs become infected and therefore seropositive. The immune response that develops following infection with the PRRS virus protects the clinically recovered pig from subsequent homologous challenge, but does not prevent the establishment of persistent infection (Benfield et al 1999a).

2.7 Vaccination

Attenuated live virus and killed virus vaccines are available overseas to control PRRS and, used judiciously, they may be of value in preventing and controlling the disease. Unless vaccines improve dramatically in efficacy, they should not be relied on to control or prevent the disease.

Genetic and antigenic differences between vaccine and field strains have been identified. However, transmission of vaccine viral strains has been reported from vaccinated sows to unvaccinated sows and from vaccinated herds to unvaccinated herds, with development of virus vaccine-induced reproductive failure (Bøtner et al 1997).

There are no vaccines currently approved for use in Australia.

2.8 Treatment of infected animals

There is no specific treatment for PRRS.

3

Implications for Australia

3.1 Potential pathways of introduction

The most likely means of PRRS entry to Australia or a herd is with subclinically or asymptotically infected live pigs, or via semen. There is also a risk that PRRS virus could be introduced into Australia in uncooked pork products if they were fed to domestic pigs.

There is always a risk that the disease could find its way into the feral pig population. If this were to happen, the virus could be difficult to contain. Its spread to domestic pigs could be limited by using sound perimeter fencing.

3.2 Social, economic and environmental effects

The social and economic effects of a PRRS outbreak would be restricted mainly to its effects on farm productivity. When introduced into a herd for the first time, PRRS causes significant reproductive failure, deaths of younger pigs, and reduced growth rates in weaner and grower pigs. There are no published estimates of the costs of a PRRS outbreak in the Australian pig industry. The impact can be extrapolated from a study by Cutler (1992) based on a typical scenario from United States disease outbreaks. In this scenario, PRRS increased neonatal mortality by 2% and postweaning mortality by 8%, and decreased feed conversion efficiency by 20% for the four-month period of the disease outbreak, equating to an annual loss of approximately A\$120 per sow in 1992 — representing an increase in the cost of production for the first year of about 8 cents per kilogram liveweight. The study did not consider the substantial impact of recurring disease in a herd over a longer period.

Although the major effects would be felt in the first year following infection in most herds, the disease is likely to persist in herds, with regular clinical recurrence. The presence of PRRS in a breeding herd would affect the marketability of breeding stock. Although there is no reason for abattoirs to be unwilling to slaughter and process pigs from IPs, local pressures may disrupt some trade practices. Restrictions that force pork from IPs or DCPs to be processed by cooking may cause inconvenience and financial penalties in the pork production chain.

Because PRRS is present in most pork-producing countries, its presence in Australia should not affect the export of pork products. However, trade of Australian breeding stock to countries free of PRRS virus would probably be affected.

A decrease in consumption of pork and pork products can be anticipated, at least in the short term. A public awareness campaign will be appropriate, stating that PRRS does not infect humans, cause disease in domestic pets or affect meat quality.

Where herds are depopulated, either by stamping out or by being sold for slaughter, producers will suffer financial loss through interruption to production flow.

Movement controls will be largely restricted to IPs and will not cause major disruptions, other than by prohibiting live pig sales. Zoning will potentially interrupt the free movement of breeding stock, the movement of pigs to slaughter at preferred markets, and the movement of pig meat to markets.

3.3 Critical factors for an Australian response

In a PRRS outbreak, authorities may attempt to intervene actively or may allow the industry to develop and adopt its own control measures with minimum regulation. The disease is expected to behave as it has done in other countries: there is nothing special about the Australian pig industry that would change the way PRRS virus is spread.

If control of the disease is left to individual producers, it is likely that many will elect to 'live with' the disease. Some will avoid the disease through herd security measures. Others will elect to take their chances and fail to invest in any significant security measures (as occurs with diseases presently endemic in the domestic pig population). The movement of replacement breeding stock and semen around the country will increase the risk of spread, as it has in other countries experiencing PRRS epidemics.

4

Policy and rationale

4.1 Introduction

4.1.1 Summary of policy

Porcine reproductive and respiratory syndrome (PRRS) is an WOAHA-listed disease that, if introduced into Australia, would significantly increase the cost of production in infected piggeries.

The overall policy is to control and then eradicate PRRS by the most cost-effective method, using stamping out or modified stamping out.

Stamping out, which could be applied in exceptional circumstances, involves quarantine, slaughter of all infected and exposed susceptible animals on infected premises, and sanitary disposal of destroyed animals and contaminated animal products.

Modified stamping out (slaughter and salvage) involves quarantine, immediate slaughter with salvage of all saleable exposed pigs at approved abattoirs, slaughter of the remaining pigs as they grow to a saleable weight, a requirement for pigs from affected farms to be processed by cooking, and prohibition of the sale of pigs from affected farms for fresh pork.

These strategies will be supported by:

- *quarantine and movement controls* on animals, on semen and on vehicles that transport pigs on infected and suspect premises, to prevent spread of infection
- *decontamination* of facilities, equipment and other items to eliminate the spread of the disease agent from infected animals and premises
- *tracing and surveillance* to determine the source and extent of infection
- *testing and treatment of infected animals* until all susceptible animals on infected premises are confirmed to be free of infection; and
- *an awareness campaign* to facilitate cooperation from the industry and the community.

Vaccination will not be used unless the eradication program fails and the disease becomes endemic, and effective vaccines are available. If PRRS becomes established in Australia, its eradication will require special industry commitment and regulatory controls.

Successful implementation of the policy will depend on total industry cooperation and compliance with all control and eradication measures.

4.1.2 Case definition

For the purposes of this manual, a case of PRRS is defined as laboratory-confirmed infection with PRRS virus in a susceptible animal with or without clinical signs.

Notes:

- Positive serology in the absence of detection of PRRS virus, with no clinical or epidemiological evidence supporting infection, does not constitute a definition of a case.
- AUSVETPLAN case definitions guide when a response to an emergency animal disease (EAD) incident should be undertaken. AUSVETPLAN case definitions do not determine when international reporting of an EAD incident is required.
- At the time of an outbreak, revised or subsequent case definitions may be developed with the agreement of the Consultative Committee on Emergency Animal Diseases – CCEAD.



Pigs need to be quarantined on infected and suspected premises.

4.1.3 Cost-sharing arrangement

In Australia, PRRS is included as a Category 4 emergency animal disease in the Government and Livestock Industry Cost Sharing Deed in Respect of Emergency Animal Disease Responses (EAD Response Agreement – EADRA).⁶ When cost sharing of the eligible response costs of an incident is agreed, Category 4 diseases are those for which costs will be shared 20% by government and 80% by industry.

4.1.4 Criteria for proof of freedom

Declaration of freedom may allow the resumption of trade in live breeding stock to countries that are PRRS free.

After an outbreak of PRRS, a statistically valid serological survey would have to be undertaken to demonstrate proof of freedom. The survey would concentrate on the RA(s) in which disease was present and on high-risk herds, based on the results of tracing and pig movements.

See Section 7 for further details on proof of freedom.

4.1.5 Governance

Governance arrangements for the response to EADs are outlined in the **AUSVETPLAN Overview**.

Information on the responsibilities of a state coordination centre and local control centre is available in the **AUSVETPLAN management manual Control centres management (Parts 1 and 2)**.

4.2 Public health implications

There are no public health implications

4.3 Control and eradication policy

The disease control options appropriate for a particular outbreak of porcine reproductive and respiratory syndrome (PRRS) will depend on practical factors, including:

- the density of pigs in an infected area
- the multi-site organisation of many pig farms
- the need to move pigs interstate for slaughter; and
- the practicality, after slaughter, of processing infected pigs by cooking.

No country in which PRRS occurs has attempted eradication of the PRRS virus. In France, the disease has been held at a low level by using conventional tests and movement controls. Reports in the literature indicate that eradication from herds or subpopulations may be possible using depopulation, or partial depopulation, and eradication by controlled exposure and careful monitoring for the presence of virus (Gramer et al 1999). Overseas exposure suggests that these measures are not always successful (Dee et al 2001, Lager et al 2002).

The disease moves relatively slowly within a herd. Provided that a PRRS incursion is detected quickly, there is time to define the extent of infection using serology (ELISA test) and make an epidemiological

⁶ Information about the EAD Response Agreement can be found at www.animalhealthaustralia.com.au/eadra.

assessment before embarking on any course of action. Serology will also identify those herds that are free of the disease and can be used as sentinels, and provides an added layer of security for those involved in the purchase and movement of pigs.

Herds can be protected against exposure by the isolation and serological testing of introduced breeding stock, followed by a 30-day quarantine period and retesting before entry to the herd (serum antibodies are detectable 7–14 days after exposure and reach maximum levels at 30–50 days).

PRRS virus does not survive drying in the environment; it only survives in live pigs and semen and may survive for a limited time in uncooked meat products. Therefore, eradication and control efforts should be focused on live animals.

In addition, although the disease is highly infectious, it is not highly contagious; transmission normally occurs where pigs are in direct contact with each other. Aerosol spread is possible, though the maximum distance the virus can spread in this manner has not been determined (see Section 2.4.2). There is therefore no need to apply disease control measures to abattoirs, meat processing premises or saleyards, and routine cleaning is all that is needed for decontamination of farm premises.

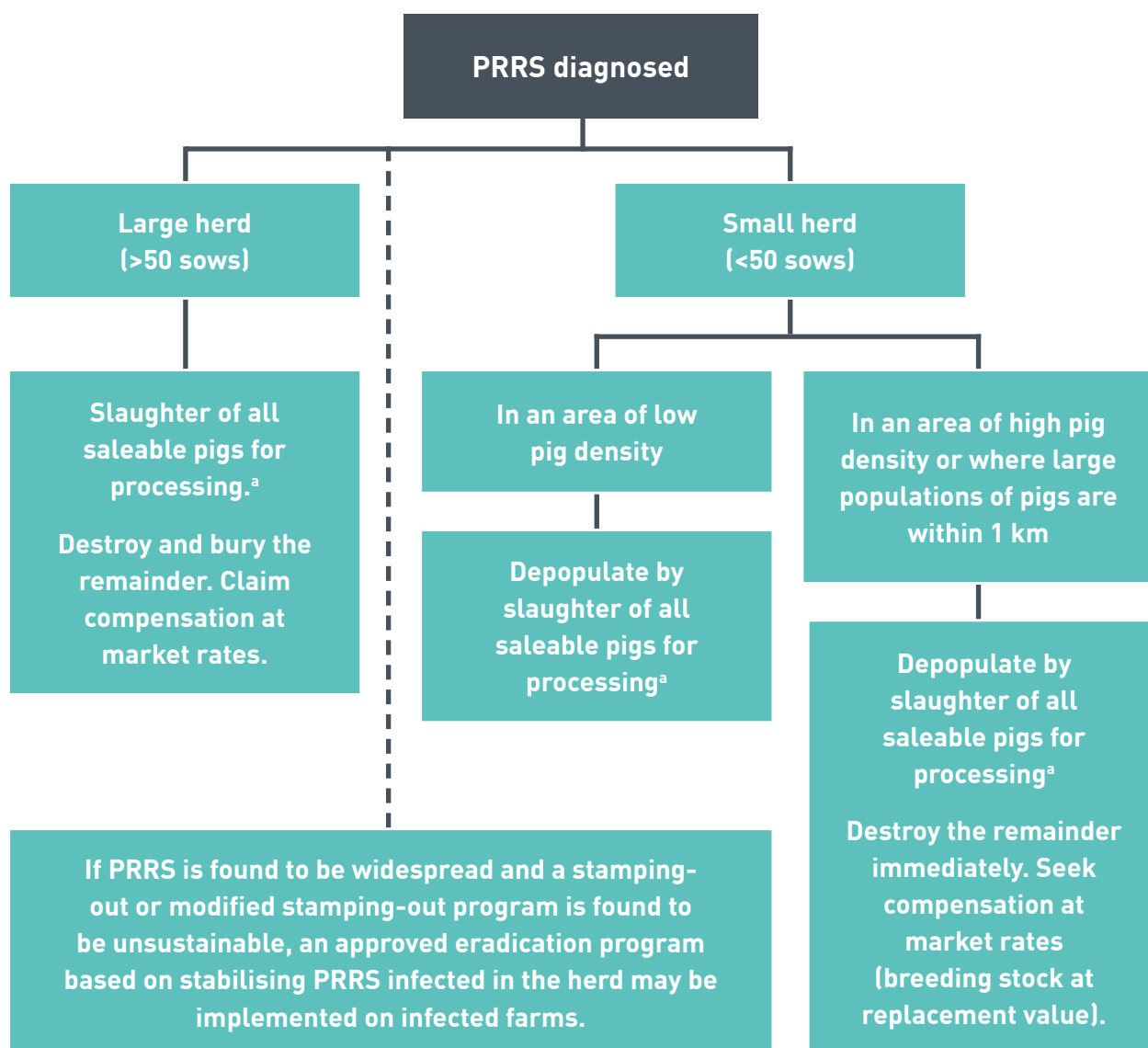
The elements of a control and eradication program for PRRS are:

- early recognition and laboratory confirmation of the disease (see Section 2.5)
- early identification of infected and potentially infected pig farms (see Section 4.3)
- rapid imposition of effective quarantine on infected and potentially infected premises (see Section 4.3)
- immediate cessation of stock movements until the status of the outbreak is established
- elimination of infection through either stamping out or modified stamping out — modified stamping out is a controlled depopulation of breeding stock and slaughter of pigs as they reach a marketable age or weight (there is no need for immediate and total depopulation, although this may be a prudent approach if the index case is in an area densely populated by pigs)
- the swift designation and effective policing of control areas to prevent movements of pigs carrying virus, or potentially carrying virus (see Section 5 and 6); and
- restriction of pork from PRRS-infected farms to processing as cooked products — this may be difficult to implement in some cases; special arrangements with abattoirs and processors may need to be made and this may have implications for the sale value of the pigs or carcasses.

A decision tree showing the factors that may affect the control strategy used for PRRS and the possible control measures (see Figure 4.1), will help to clarify disease control decisions.

In the event that the virus becomes widespread before it is detected, the key elements of control are:

- identification of infected farms by serological survey
- supervision of individual herd eradication by a veterinarian
- quarantine of the infected herds to prevent movement of live animals, except to slaughter
- an approved control program that may involve vaccination of seronegative replacement breeding stock 60–90 days before introduction, and breeding to stabilise infection and eliminate it over a three-year period
- introduction of seronegative sentinel pigs to test for viral shedding; and
- multi-site production systems to separate susceptible progeny from the breeding herd.



^a = Process by cooking at the temperatures given in section 4.3.10

Figure 4.1. Factors that may affect the control strategy and possible control measures

4.3.1 Epidemiological assessment

Epidemiological investigation or assessment draws on multiple sources of information to build understanding of the disease and how it is behaving in an outbreak. This helps inform response decision making.

The key objectives for an epidemiological assessment will be to identify:

- the spatial distribution of infected and free animal populations
- the source of infection
- the prevalence of infection
- pathways of spread and the likely size of the outbreak
- risk factors for the presence of infection and susceptibility to disease (including weather and insect populations).

Epidemiological assessment, and tracing and surveillance activities (see Section 4.3.3) in an EAD response are interrelated activities. Early findings from tracing and surveillance will be inputs into the initial epidemiological assessment (eg considering spatial distribution of infection). The outcomes of the initial epidemiological assessment will then guide decisions on subsequent tracing and surveillance priorities.

The outcomes of the epidemiological assessment will also be used to guide the selection of other appropriate response measures (including the application of movement controls) and assess the progress of disease control measures.

Ongoing epidemiological assessment is important for any EAD response to aid evaluation of the continued effectiveness and value of response measures. Ongoing epidemiological assessment will consider the outcomes of tracing and surveillance activities, and will contribute evidence to support any later claims of disease freedom.

4.3.2 Quarantine and movement controls

The disease can spread rapidly between farms if quarantine of infected premises (IPs) and movement controls are not immediately introduced. Quarantine and movement controls will therefore be imposed on IPs, dangerous contact premises (DCPs) and suspect premises (SPs) as these are identified through tracing and surveillance (see section 4.3.3).

A restricted area (RA) and a control area (CA) will be declared to provide the necessary control to enable eradication measures to be implemented. The RA should include the IPs, DCPs and as many of the SPs as possible, and should be as large as is necessary for satisfactory control.

The movement of pigs within the RA will be restricted. Normally, pig movements from the RA should be permitted only if they are direct to slaughter, unless serological testing and other conditions are met (see Section 6). The CA will be declared with the express purpose of facilitating access to slaughter for infected stock, and therefore could cross state borders.

Pigs from IPs, DCPs and SPs should not be moved off the premises except for direct transfer to an abattoir. They should be slaughtered within four hours of arrival at the abattoir, or more than six hours off feed, whichever is the later. Live pig sales within the RA will be banned to reduce the possibility of spread. All movements of pigs will be subject to permit. There is no need to impose restrictions on other premises in the RA once they have been cleared of pigs and have been cleaned and disinfected.

Ducks present a very minor risk of spreading the disease and are unlikely to be the focus of an eradication effort. Where ducks are present on an infected farm, they should be destroyed or slaughtered for sale as meat to reduce any local viral contamination.

See Section 5 for further details on declared areas.

See Section 6 for further details on quarantine and movement controls.

Quarantine

PRRS virus is spread mainly by direct contact with infected pigs or via infected semen. Quarantine should therefore be imposed on all farms on which infection is either known or suspected while health status is assessed.

To achieve the required level of security for infected premises (IPs) or dangerous contact premises (DCPs), no pigs should be moved onto the property and the only pigs allowed off should be those destined for immediate slaughter. If one part of a multi-site farm is infected, all parts should be

considered to be a suspect premises (SP) in the first instance. Later decisions can be made on the basis of serological sampling and disease control options.

Movement controls

Movement controls include:

- pig movements off the IP, DCP and SP only allowed under permit (including movement between the different sections of a multi-site farm); and
- control of movement of carcasses for further processing (by cooking).

All vehicles used to transport infected pigs should be decontaminated, but otherwise there is no need to disinfect trucks or fomites. Effluent may be removed from the property, provided it goes to a property that does not have any pigs.

For people, it is sufficient to insist on a change of boots and clothing as they leave the premises.

A restricted area (RA) and control area (CA) should be declared to allow eradication measures to be implemented. The RA should include the IPs and the DCPs. The size of the declared areas will depend on epidemiological information at the time of the outbreak and should be as large as is necessary for satisfactory control. A ban on live pig sales within the RA should be implemented.

For further information on declared areas, quarantine and movement controls, see Section 5 and 6.

4.3.3 Tracing and surveillance

Tracing

When infection is suspected or confirmed in a piggery, trace-back and trace-forward identify other infected piggeries. Because people and fomites are not important vectors in an outbreak of PRRS, the most important tracing would be of pig movements. Pork products are only worth following up if swill feeding is suspected. In general, they can be considered a low priority.

The movement of live pigs to and from IPs must be traced from at least 60 days before the first clinical signs were observed in neonatal pigs to the time quarantine is imposed. This timespan allows for a period of asymptomatic infection in sows before clinical signs emerge in their litters. Live pigs and semen are the main sources of infection, and tracing should focus on them.

Surveillance

Initial surveillance should aim to assess the spread of infection, thereby assisting the development of the control strategy. Further surveillance may be needed during implementation of the strategy.

Surveillance needs to be undertaken on premises that have received any pigs from the IP and on other premises, particularly breeder properties, so that other IPs, DCPs or SPs can be identified.

Where premises have been destocked they can, with the approval of the CVO, be restocked a minimum of 14 days after decontamination is completed. Surveillance of restocked animals will be maintained for 60 days, with follow-up serology six weeks later.

Surveillance will need to be maintained throughout the eradication period and continue afterwards, so that proof of freedom can be supported with reliable scientific information.

Live pig and semen movements are the most likely route of disease spread, so special attention should be paid to piggeries with a history of recent introductions, artificial insemination stations, and piggeries selling breeding or grower stock.

The purpose of surveillance is to identify any infected piggeries not already identified by tracing. Activities include locating piggeries, physically inspecting pigs, blood-sampling a statistically significant number of pigs, and examining production records for evidence of reproductive failure, stillborn pigs and neonatal mortalities.

Serosurveillance will be of most value in herds in which the clinical syndrome is asymptomatic. In areas where feral pigs are evident and in contact with domestic pigs, serological sampling is indicated.

See Section 7 for further details on surveillance.

4.3.4 Zoning and compartmentalisation for international trade

Where it is not possible to establish and maintain disease freedom for the entire country, establishing and maintaining disease-free subpopulations, through zoning and/or compartmentalisation,⁷ may be considered.

In the case of a limited disease outbreak, a containment zone⁸ may be established around the areas where the outbreak is occurring, with the purpose of maintaining the disease-free status of the rest of the country outside the containment zone.

All zoning applications would need to be prepared by the Australian Government in conjunction with the relevant jurisdiction(s) and agreed to by the CCEAD. Zoning is usually negotiated after a disease outbreak has begun.

Compartmentalisation applications typically need to be negotiated before an outbreak occurs, and will require input from the relevant industries.

Recognition of both zones and compartments must be negotiated between the Australian Government and individual overseas trading partners. Zoning and compartmentalisation would require considerable resources that could otherwise be used to control an outbreak. Careful consideration will need to be given to prioritising these activities, because the resulting competition for resources could delay the quick eradication of the disease and recognition of disease freedom.

Agreements between trading partners take time to develop, consider and finalise, because of the need to provide detailed information on activities such as biosecurity, surveillance, traceability and diagnostics to support the approach that is developed. An importing country will need assurance that its animal health status is not compromised if it imports from an established disease-free zone in Australia. Trading partners may not accept a zoning or compartmentalisation proposal, regardless of the information provided. Eradication of disease may be achieved before zoning or compartmentalisation applications are finalised.

The WOAHP guidelines for zoning and compartmentalisation are in Chapters 4.4 and 15.1 of the WOAHP *Terrestrial animal health code*.

4.3.5 Vaccination

Vaccines have been used overseas, but not in eradication campaigns. Import of vaccine into Australia would be subject to approval from the Australian Pesticides and Veterinary Medicines Authority and

⁷ With zoning, disease-free subpopulations are defined primarily on a geographical basis. With compartmentalisation, disease-free subpopulations are defined primarily by management practices (such as the biosecurity plan and surveillance practices of enterprises or groups of enterprises).

⁸ The WOAHP defines a 'containment zone' as an infected zone within a previously free country or zone, which includes all suspected or confirmed cases that are epidemiologically linked and where movement control, biosecurity and sanitary measures are applied to prevent the spread of, and to eradicate, the infection or infestation. The Australian Government Department of Agriculture, Fisheries and Forestry commissioned a report on what would be required for the establishment of containment zones in Australia. This report is available at www.ausvet.com.au/tools-resources.

the Australian Quarantine and Inspection Service. The efficacy of current PRRS virus vaccines is questionable.

The use of vaccines is contraindicated because of the risk that vaccine strains will cause disease in susceptible naive populations of pigs (see Section 2.7). Vaccines will not be permitted as part of the first stages of an eradication strategy. However, in the longer term, if the disease were to become established and if vaccines were known to be effective, their use could be permitted under controlled conditions.

4.3.6 Treatment of infected animals

There is no effective treatment for animals.

4.3.7 Treatment of animal products and byproducts

Animals with clinical signs must not be sent to slaughter. Animals sent to abattoirs for immediate slaughter must be handled with care to prevent contamination of meat with intestinal contents. The head and neck meat with lymph nodes should be removed and disposed of by rendering and the other meat processed by cooking to inactivate the virus, which might otherwise survive in muscle tissue and cause spread of the disease.

Processing of pig products using cooking, curing and rendering techniques is sufficient to inactivate PRRS virus; such products present minimal threat of spreading disease. A more serious threat is from the meat of viraemic pigs when it is fed raw to susceptible pigs (see Section 2.4.2). Hence, intensified publicity and policing of swill-feeding bans is appropriate during an outbreak.

Infected or possibly infected semen should be destroyed.

Meat or meat products from pigs from IPs should be heated to a minimum core temperature of 56°C for at least 60 minutes, or the equivalent as shown in Table 4.1.

Table 4.1 Minimum core temperatures and times for treating meat or meat products from pigs from infected premises

Temp (°C)	Time (minutes)	Temp (°C)	Time (minutes)
56	60	64	22
57	55	65	20
58	50	66	17
59	45	67	15
60	40	68	13
61	35	69	12
62	30	70	11
63	25		

Note: The temperature and time used must be recorded. The temperature recording equipment should be checked during the cooking process and found to be in good order. Records should confirm that the times and temperatures specified above were achieved.

4.3.8 Destruction of animals

Pigs showing clinical symptoms cannot be sent to an abattoir and would need to be destroyed on the IP, or held in quarantine until the symptoms pass. Pigs could be moved to an approved off-site finishing unit if that unit is part of the farm's production system (for example in a multi-site system), or to assist in the clean-up and restocking of an IP. Approval for pigs to be moved to another premises should only be granted if that premises is more than two kilometres from other pigs.

Pigs can be permitted to move to an approved abattoir, however, as long as they are slaughtered within 4–6 hours of arrival. This will minimise the contamination of lairages by pigs shedding PRRS virus, thereby preventing infection of pigs coming to the abattoirs from other piggeries. Killing all pigs from an IP within four hours of arrival at the abattoirs and after at least six hours off feed (whichever is the later) will also minimise the spread of infection and the number of viraemic carcasses entering the food chain.

Carcasses of pigs from IPs must be processed by cooking at temperatures described in Section 4.3.10. Rendered animal products must be treated according to the same principles.

In some cases, the interstate movement of pigs for slaughter and further processing (by cooking) will be necessary. This can be allowed under permit.

The need for destruction of animals on farm premises will depend on which policy is adopted for the eradication of PRRS (see Figure 4.1). If the stamping-out policy is adopted, pigs will be slaughtered on IPs, and possibly on DCPs, according to circumstances. If the modified stamping-out policy for salvage and slaughter is adopted, pigs will be transferred to an abattoir for slaughter. However, even under the modified policy, unsaleable or clinically affected pigs not suitable for abattoir slaughter, or not able to be grown out under quarantine for later slaughter, would be destroyed on IPs. See the **AUSVETPLAN operational manual *Destruction of animals*** for appropriate methods for the destruction of pigs.

Because there is experimental evidence that ducks can be infected with PRRS virus (see Section 2.2), any ducks on the premises should be isolated or removed.

Destruction of animals other than pigs and possibly ducks is unnecessary. Destruction of property is unnecessary, as PRRS virus is susceptible to high temperature, desiccation, cleaning and disinfection.



Ducks can potentially be infected with PRRS and should be isolated or removed.

Stamping out

The preferred strategy is to use stamping out sparingly and to attempt to salvage as many animals as possible.

Stamping out is only an option when:

- the infected herd is small and isolated
- the infected herd is the first case in an area with a dense pig population; or
- there are multiple farms within a one-kilometre radius of an IP.

Under a stamping-out policy, live pigs would not be permitted to move from the IPs or DCPs. Only carcasses could be moved, either to another property for burial or to an approved place for rendering. The slaughtered animals will be disposed of by the most appropriate means for the particular situation. Slaughter and salvage of saleable carcasses is the preferred option.

Modified stamping out requires initial quarantine of the IP, followed by slaughter of all saleable pigs at an abattoir. The fate of the remaining pigs on the farm could include one or more of the following:

- destruction of unsaleable pigs on the IP, with compensation, or allowing growing pigs to grow out under prescribed restrictions or quarantine
- slaughter of nonpregnant sows; and
- slaughter of pregnant sows or allowing pregnant sows to farrow and wean their litters to grow out under prescribed restrictions or quarantine.

The decisions made will reflect the logistics of further processing, by cooking, of relatively small numbers of sows or growing pigs.

Tracing and surveillance will be important to determine the distribution of the disease and the herd prevalence, so that the best strategy may be selected.

4.3.9 Disposal of animals, and animal products and byproducts

There are no special considerations in disposal of PRRS virus infected pigs or pig products. Pig carcasses may be rendered (see the **AUSVETPLAN operational manual *Disposal***).

4.3.10 Decontamination

The PRRS virus does not survive in the environment for an extended period. The normal day-to-day disinfection procedures of commercial pig farms will reduce the risk of recurring infection when herds are restocked. PRRS virus is susceptible to temperature and a range of chemicals (see the **AUSVETPLAN operational manual *Decontamination***).

There is no special decontamination requirement for people, fomites and vehicles that are not involved in the transport of pigs, apart from ensuring that they are free from contamination with pig excreta. Fomites do not appear to be implicated in the spread of PRRS, especially in climates similar to Australia's.

Decontamination is only appropriate after piggeries have been depopulated. Routine cleaning of the pig accommodation areas using a commercially available phenolic or organic acid disinfectant is all that is required. Detergents are recommended to assist cleaning.

Thorough cleaning and disinfection of vehicles used to transport infected pigs, loading ramps at abattoirs and other potentially infected areas will minimise the spread of infection.

4.3.11 Wild animal management

As there is experimental evidence that ducks can be infected with PRRS virus (see Section 2.4.2), any ducks on the premises should be removed or isolated. No other species have been implicated in the spread of the disease.

Perimeter fencing will prevent the spread of disease to feral pigs. In feral populations, it is expected that the disease would be spread by direct contact and involve clinical signs similar to those observed in domestic pigs. Infected feral pigs can be prevented from re-infecting the domestic herd by one-metre high ringlock perimeter fencing.

Protection of the domestic herd from feral pigs would be the best and most cost-effective strategy if the disease should enter the feral pig population. For feral pig control methods, refer to the **AUSVETPLAN operational manual *Wild Animal Response Strategy***.

4.3.12 Public awareness and media

Outbreaks of PRRS should be well publicised, with emphasis on the dangers of feeding animal products to pigs and the fact that unlicensed swill feeding is illegal. People caught feeding or providing material for swill should be prosecuted promptly and successful cases publicised. Security at municipal garbage tips should be tightened to prevent wild pigs gaining access to domestic food scraps.

Piggery owners should be advised to adopt adequate precautions to prevent the entry of PRRS virus. Best-practice precautions are:

- no pig introductions (unless from herds known to be free of PRRS virus)
- minimal numbers of visitors (with those who enter to use boots and overalls held at the piggery)
- perimeter fences to exclude feral and domestic animals
- no feed bins on perimeter fences — secure feed bins to prevent feral animal access;
- pig-loading facilities at perimeter fences; and
- cleaning and disinfection of pig-carrying trucks after unloading.

The veterinary authorities must explain the control measures to the industry and to individuals who are directly affected, in order to gain their confidence in the measures being imposed. The media and public must be informed about the disease and the control arrangements so that buyer confidence in the product is maintained and any effect on the market reduced.

A special publicity campaign should be instituted about the swill-feeding regulations and the potential role of untreated swill in PRRS infection.

For further information, see the **Public Relations Manual**.

4.3.13 Other strategies

Individual producers will see significant production benefits from preventing PRRS virus from establishing in their herds. The strategy to prevent PRRS entering previously uninfected herds is the same as for many other pig diseases: single-source supply of breeding stock, a quarantine process for new introductions, and perimeter fencing. In addition, considerable productivity improvements can be gained by eliminating PRRS virus from infected herds.

However, the costs of disease eradication programs such as depopulation and repopulation are high. Availability of clean replacement stock and risks of reinfection need to be incorporated into a cost-benefit analysis before this course of action is taken.

The objective, while CCEAD considers it feasible, will be to eradicate the disease. PRRS has never been eradicated from a country in which it has become established. However, provided that tracing and surveillance can identify the infected herds and the industry has the will to apply strict movement controls and good hygiene and management practices, eradication is possible.

CCEAD would advise the NMG if the disease is endemic. The combat jurisdiction(s) would then lift some or all of the regulatory restrictions and would move to a disease management strategy.

4.3.14 Stand-down

Destocked piggeries can be restocked without risk of reinfection a minimum of 14 days after decontamination procedures have been completed and the pens and buildings allowed to dry out.

As a safety measure, and to demonstrate eradication success, newly stocked farms should be serologically tested 60 days after restocking and again six weeks later.

4.4 Other control and eradication options

Following infection, some producers could be expected to eliminate infection through farm-based depopulation programs combined with salvage and slaughter. Vaccination strategies could also be employed to control the disease to the point where eradication from a farm becomes possible. The success of these programs relies on a high level of planning, skilled farm management, informed veterinary advice, and the availability of effective vaccines and replacement breeding stock free of PRRS virus.

In the United States, the disease has been successfully eradicated from individual herds or subpopulations following depopulation or controlled exposure and segregated early weaning (Harris 2000). Eradication using controlled exposure may be feasible, but only after the infection has spread through the breeding herd and has been stabilised. However, this approach to control is new, and it would be premature to use it in a country where the disease has been detected for the first time and where there is a chance to eradicate the disease before it becomes endemic.

Notwithstanding this, there is a likelihood that an index case will occur in a herd that contains illegally imported pigs, that has had illegally imported semen introduced, or that has been illegally swill-fed. In such a case, the criteria favouring successful eradication (ie rapid diagnosis and limited spread) may not be met. An understanding of how far the disease may have spread will increase the chances of success of the eradication effort. This will be determined by serological surveillance and tracing.

4.5 Funding and compensation

Details of the cost-sharing arrangements can be found in the Government and Livestock Industry Cost Sharing Deed in Respect of Emergency Animal Disease Responses.⁹ Details of the approach to the valuation of, and compensation for, livestock and property in disease responses can be found in the **AUSVETPLAN operational manual *Valuation and compensation***.

⁹ www.animalhealthaustralia.com.au/eadra

5

Declared areas and premises

When an emergency animal disease (EAD) is first suspected, the premises involved would undergo a clinical and/or epidemiological investigation. If the case definition, as defined in the relevant AUSVETPLAN response strategy, is met (ie the index case¹⁰), the relevant chief veterinary officer (CVO) or their delegate will determine the premises classification and may declare the premises an infected premises (IP).

After the identification of the first IP, a restricted area (RA) and a control area (CA) may be declared.¹¹ A transmission area (TA) may also be defined, if appropriate. All premises within these areas will be classified. At the beginning of an EAD incident, the initial premises classifications would be IP, at-risk premises (ARP), premises of relevance (POR), unknown status premises (UP) and zero susceptible species premises (ZP).

Any premises within the RA or CA will have only one classification at any one time. After an epidemiological investigation, clinical assessment, risk assessment or completion of control measures, a premises may be reclassified.

Once the first IP has been identified, intelligence gathering through veterinary epidemiological investigations would quickly lead to the identification of suspect premises (SPs) and trace premises (TPs). These would be high priorities for follow-up investigation by the relevant state or territory authorities. In a worst-case scenario, an SP could become an IP; therefore, SPs need to be investigated as a matter of very high priority. Similarly, investigation and risk assessment of a TP might identify it as an IP, dangerous contact premises (DCP) or dangerous contact processing facility (DCPF). An SP or TP might also be assessed as negative and qualified as SP-AN or TP-AN, and eventually reclassified as an ARP, POR or ZP.

All premises classifications are subject to change as a result of a modification in the case definition(s) or investigation(s) as the incident response proceeds.

Classifications should be applied with information needs of managers in mind. They should assist managers to monitor and report progress. Premises classifications to be used should be agreed early in a response, so that control centre personnel can apply the correct and consistent classifications and definitions from the outset of the investigation and response.

5.1 Declared areas

Maintaining movement restrictions on areas for long periods has important implications for resource management, animal welfare, business continuity, and socioeconomic impacts on producers and regional communities.

¹⁰ The first case to come to the attention of investigators

¹¹ This is invariably the case with highly contagious diseases (eg foot-and-mouth disease, equine/avian/swine influenza, classical swine fever) but may not apply to less contagious diseases (eg Hendra virus, anthrax, Australian bat lyssavirus).

During the course of an EAD response, it may become necessary for a CA or RA to be expanded, as additional geographical areas or new foci of infection are identified. Later in the response, as control is achieved, mechanisms for gradually reducing the size of the CA and RA can be introduced.

An EAD may involve multiple foci of infection, with several jurisdictions potentially involved. Since disease might be controlled at different rates in different areas, there may be the opportunity to progressively lift restrictions on an area basis. This would involve reclassifying previously declared areas (RAs and CAs), with a staged approach to lifting of movement restrictions. This is a key step in the recovery process and will have positive benefits on the community.

5.1.1 Restricted area (RA)

An RA is a relatively small legally declared area around IPs and DCPs that is subject disease controls, including intense surveillance and movement controls.

An RA will be a relatively small declared area¹² (compared with a CA) drawn with at least 2 km radius around all IPs and DCPs, and including as many SPs, TP and DCPFs as practicable. Based on risk assessment, the RA is subject to intense surveillance and movement controls. The purpose of the RA is to minimise the spread of the EAD. The RA does not need to be circular but can have an irregular perimeter, provided that the boundary is initially an appropriate distance from the nearest IP, DCP, DCPF, SP or TP. Multiple RAs may exist within one CA.

The boundaries will be modified as new information becomes available, including from an official surveillance program. The actual distance in any one direction will be determined by factors such as terrain, the pattern of livestock movements, livestock concentrations, the weather (including prevailing winds), the distribution and movements of relevant wild (including feral) animals, and known characteristics of the disease agent. In practice, major geographic features and landmarks, such as rivers, mountains, highways and roads, are frequently used to demarcate the boundaries of the RA. Although it would be convenient to declare the RA on the basis of local government areas, this may not be practical, as such areas can be larger than the particular circumstances require.

5.1.2 Control area (CA)

A CA is a legally declared area where the disease controls, including surveillance and movement controls, applied are of lesser intensity than those in an RA (the limits of a CA and the conditions applying to it can be varied during an incident according to need).

A CA is a disease-free buffer between the RA and the outside area (OA). Specific movement controls and surveillance strategies will be applied within the CA to maintain its disease-free status and prevent spread of the disease into the OA.

An additional purpose of the CA is to control movement of susceptible livestock for as long as is necessary to complete tracing and epidemiological studies, to identify risk factors and forward and backward risk(s).

The CA will be a larger declared area around the RA(s) – initially, possibly as large as the state or territory in which the incident occurs – where restrictions will reduce the risk of disease spreading from the RA(s). The CA will have a minimum radius of 10 km, encompassing the RA(s). It may be defined according to geography, climate and the distribution of relevant wild (including feral) animals. The boundary will be adjusted as confidence about the extent and distribution of the incident increases.

¹² As defined under relevant jurisdictional legislation

In general, surveillance and movement controls will be less intense in the CA than in the RA, and disease-susceptible animals and their products may be permitted to move under permit within and out of the area.

5.2 Other areas

It is possible that other types of areas (eg vaccination area or surveillance area), which are not legally declared, may be used for disease control purposes in some jurisdictions.

5.3 Premises classifications

Detailed guidelines for classifying premises statuses are provided in the **AUSVETPLAN guidance document *Declared areas and application of premises classifications in an EAD response***, and the definitions are in the Glossary.

5.3.1 Premises status classifications

For porcine reproductive and respiratory syndrome (PRRS), the premises classifications to be used are:

- infected premises (IP)
- suspect premises (SP)
- trace premises (TP)
- dangerous contact premises (DCP)
- dangerous contact processing facility (DCPF)
- approved processing facility (APF)
- approved disposal site (ADS)
- at-risk premises (ARP)
- premises of relevance (POR)
- resolved premises (RP)
- unknown status premises (UP)
- zero susceptible species premises (ZP).

5.3.2 Qualifiers

Please also refer to the **AUSVETPLAN guidance document *Declared areas and premises classifications*** for more detail on qualifiers.

For porcine reproductive and respiratory syndrome (PRRS), the qualifiers to be used are:

- assessed negative (AN)
- sentinels on site (SN)
- vaccinated (VN).

5.4 Reclassifying premises and previously declared areas

Maintaining movement restrictions on areas for long periods has important implications for resource management, animal welfare, business continuity, and socioeconomic impacts on producers and regional communities. Therefore, attention should be given to reclassifying premises and previously declared areas as quickly as possible.

Detailed guidelines for reclassifying previously declared areas are provided in the **AUSVETPLAN guidance document *Declared areas and application of premises classifications in an EAD response***.

5.4.1 Reclassifying premises

Guidelines for assessing SPs and TPs as negative and reclassifying their status are outlined in Section 7.1.2.

IPs and DCPs require action to address the risk that infection and/or contamination with porcine reproductive and respiratory syndrome virus (PRRS virus) is present. To assess an IP, DCP or DCPF that houses susceptible as negative – and allow its reclassification, release from biosecurity controls and restocking – consideration must be given to the effectiveness of pathogen elimination through decontamination (through natural, physical and/or chemical means) and where appropriate, placement of sentinel animals.

The actual time before placement of sentinel animals should consider a range of factors, including:

- factors affecting pathogen viability and infectivity (eg substrate protein or lipid content, ambient temperature, water content, and virulence and quantum)
- confidence in the decontamination process through natural, physical and/or chemical means.

Guidance on the use of sentinel animals, where appropriate, before release from biosecurity controls and restocking is provided in Section 7.1.2.



5.4.2 Reclassifying previously declared areas

The lifting of restrictions in declared areas is managed by jurisdictions according to their local legislation, regulations and processes.

The key principles for reclassifying a previously declared area during a response should include the following, noting that not all will be relevant for some diseases:

- The area should be epidemiologically distinct from other declared areas.
- All TP and SPs have been investigated and reclassified, and all IP, DCP and DCPFs in the area have been reclassified as RP (or APFs).
- All tracing and surveillance associated with EAD control has been completed satisfactorily, with no evidence or suspicion of infection in the area.
- A minimum period of 28 days¹³ has elapsed since predetermined disease control activities and risk assessment were completed on the last IP or DCP in the area or a risk assessment supports reclassification.
- An approved surveillance program (including the use of sentinel animals, if appropriate) has confirmed no evidence of infection in the RA (see below).
- For vector-borne diseases, vector monitoring and absence of transmission studies indicate that vectors are not active.

Lifting of restrictions is a process managed by the relevant CVO under jurisdictional legislation and consistent with the most current agreed Emergency Animal Disease Response Plan (EADRP). When the appropriate conditions are satisfied, an affected jurisdiction can, in consultation with the Consultative Committee on Emergency Animal Diseases (CCEAD), reduce the size of either or both the CA and RA or lift all restrictions as surveillance/monitoring indicates change in risk. The previous part of the RA would then become part of the CA. Jurisdictions should be able to present documented evidence that the appropriate conditions have been met.

When an RA is lifted and becomes part of the CA, it will have a lower risk status, and the movement restrictions that apply will be consistent with those applying within the CA. Over time, all of the RAs will be reduced and lifted.

If more than one jurisdiction is affected, each will use its own appropriate legal jurisdictional mechanisms to lift the declaration of the RA or CA, coordinating with each other and consulting with the CCEAD to ensure wide communication and coordination.

After a further period of surveillance and monitoring, and provided that the additional surveillance and monitoring find no evidence of infection, a jurisdiction, in consultation with the CCEAD, could lift the CA. This would result in the lifting of all the remaining regulatory controls associated with the response, and a return to business as usual.

¹³ The minimum period uses, or is based on, the disease-specific incubation periods defined by the WOA – two incubation periods is a common guideline.

6

Movement controls

6.1 Principles

The principles for the recommended quarantine practices and movement controls are as follows:

- Containment and eradication of porcine reproductive and respiratory syndrome (PRRS) is the highest priority. Therefore, 'normal business movements' are not allowed.
- Live animals pose the greatest risk of disease spread; therefore, their movements from all premises within the restricted area (RA) and control area (CA) must be strictly controlled.
- The outside area (OA) should remain as 'clean' as possible. Therefore, movement of animals from the RA to the OA is prohibited, and movement of products is generally prohibited. Movement of animals and products from the CA to the OA will also be restricted.
- Trace premises (TP) and suspect premises (SP) are temporary classifications, and every effort should be made to resolve the status of these premises as soon as possible.
- The numbers of susceptible animals within the RA should be minimised. Therefore, movements of animals into the RA will be limited and usually for slaughter only.
- Movement restrictions are more stringent within the RA than within the CA, and will be more stringent in the early stages of the response.
- Movement controls may be varied during a response from those listed here. However, this will involve a variation to the agreed Emergency Animal Disease Response Plan, with endorsement by the Consultative Committee on Emergency Animal Diseases (CCEAD) and the National Management Group (NMG).
- Recommended movement controls apply to any movement off a premises, whether on foot or by vehicle, that involves either public or private land.
- All movement control matrixes and narratives are for guidance.
- Application for a movement permit does not automatically mean that one will be granted.
- In emergency or exceptional circumstances, any proposed movement may be considered by the jurisdictional chief veterinary officer (CVO) on a risk-assessed case-by-case basis.
- Interstate movements will need to meet the import requirements of the receiving jurisdiction.

6.2 Guidelines for issuing permits

In an emergency animal disease (EAD) event, quarantine and movement controls must strike a balance between quick and effective disease control and business continuity. Therefore, it is not appropriate to simply prohibit all movement of animals and products. On the other hand, diligence needs to be applied to minimise the risk of further spread of the disease.

Recommended biosecurity and movement controls in each AUSVETPLAN response strategy provide guidance on which movements can be allowed and under what conditions. This is based on an analysis of the disease risks that are presented by a specific movement, of a specific commodity, at a specific time during the EAD response phase. Each disease strategy will indicate whether a proposed movement is:

- allowed (under normal jurisdictional, including interstate, requirements)
- prohibited – except under the conditions of a general, special or emergency permit
- prohibited.

Permits may not be available until the relevant CVO provides approval for movements, and this may not be available in the early stages of a response. When assessing risk for the purposes of issuing a permit, the elements to consider may include:

- sources of risk
 - risk material such as live or dead susceptible animals, semen, embryos, meat, meat products, waster products, offal, paunch screenings, manure, render material, fertiliser, biological specimens, casings, used wrappers and cartons, effluent, fomites (vehicle, people, nonsusceptible animals, crops, grains, hay silage and mixed feeds)
 - presence of disease agent on both the originating and destination premises, and uncertainty
 - location of source and destination premises
 - fate at destination premises (eg for slaughter vs for growing out)
 - current vector activity, if relevant
 - organisation and management issues (ie confidence in animal tracing and surveillance, biosecurity)
 - proposed use of the animals or products
 - proposed transport route
 - vaccination status of the animals, if relevant
 - treatment of animals and vehicles to prevent concurrent movement of vectors, if relevant
 - security of transport
 - security and monitoring at the destination
 - environment and natural events
 - community and human behaviour
 - risk of sabotage
 - technology
 - regulations and standards
 - available resources for compliance and enforcement
- areas of impact
 - livestock health (health of affected species, including animal welfare)
 - human health (including work health and safety)
 - trade and economic impacts (including commercial and legal impacts)
 - environmental impacts
 - organisational capacity
 - political impacts
 - reputation and image

- proposed risk treatment measures
 - vaccination
 - destruction of animals
 - processing of product
 - disinfection or other treatment of animals, vehicles and fomites
 - vector control, if relevant
 - security
 - communication.

6.3 Types of permits

Permits are either general or special. Emergency permits are a form of special permit. Permits are legal documents that describe the animal(s), commodities or things to be moved, the origin and destination, and the conditions to be met for the movement. Either type of permit may include conditions. Once permit conditions have been agreed from an operational perspective, all permit conditions must be met for every permit. Both general and special permits may be in addition to documents required for routine movements between or within jurisdictions (eg health certificates, waybills, consignment notes, National Vendor Declarations – NVDs).

General permit

General permits (GPs) are used for lower-risk movements, and create a record of each movement to which they apply. They are granted without the need for direct interaction between the person moving the animal(s), commodity or thing and a government veterinarian or gazetted inspector of stock. The permit may be completed via a webpage or in an approved place (such as a government office or commercial premises). A printed version of the permit must accompany the movement. The permit may impose preconditions and/or restrictions on movements. GPs may not be available until the relevant CVO gives approval for general movements, and this may not be available in the early stages of a response.

Special permit

Special permits (SpPs) are issued by the relevant government veterinarian or gazetted inspector of stock. They are used for higher-risk movements, and therefore require formal application and individual risk assessment. SpPs describe the requirements for movement of an animal (or group of animals), commodity or thing, for which a specific assessment has been conducted by the relevant government veterinarian or gazetted inspector of stock. A printed version of the permit must accompany the movement. The permit may impose preconditions and/or restrictions on movements.

Emergency permit

An emergency permit is an SpP that specifies strict legal requirements for an otherwise high-risk movement of an animal, to enable emergency veterinary treatment to be delivered, to enable animals to be moved for animal welfare reasons, or to enable any other emergency movement under exceptional circumstances. These permits are issued on a case-by-case basis under the authorisation of the relevant CVO.

Other movement requests

Movements not reflected within any of the movement control matrixes or narratives may be considered by the relevant jurisdictional CVO on a risk-assessed case-by-case basis.

6.4 Recommended movement controls

Premises

Note: DCPs and SPs will be treated as IPs until there is sufficient serological evidence to change their classification.

Quarantine/ movement controls	Infected, suspect and dangerous contact premises
Movement out of:	
Susceptible pigs	<p>No pig from an IP or DCP should be moved to another premises unless the movement is under permit or prescribed restrictions.</p> <p>Pigs on an IP or DCP can be moved out under permit direct to an abattoir for slaughter within 4–6 hours of arrival.</p> <p>In the initial stages of the disease declaration, pigs from DCPs can be moved and slaughtered under the same provisions as those covering IPs. After a negative serological test, DCPs can be considered free of PRRS and the pigs moved for slaughter and normal processing.</p>
People	<p>Protective clothing, including boots, should be provided on the property for visitors. Before leaving, visitors should wash their hands in a soapy or disinfectant solution. The hygiene standards that apply are those employed in regular good farm practice.</p>
Dead pigs	Dead pigs may be removed from the premises for rendering or burial only.
Vehicles, equipment and effluent	<p>No restriction on vehicles (subject to effective cleaning and disinfection), but movements should be kept to a minimum. Veterinary instruments used on the IP or DCP should be sterilised before being taken from the premises.</p> <p>Effluent can be applied to paddocks as long as there is no pig contact with the effluent for two weeks after it is applied.</p>
Movement in and out of:	
Specified animal products	<p>Infected or potentially infected semen will be destroyed.</p> <p>Movement of semen is not permitted.</p> <p>After slaughter, meat from pigs originating from IPs must be processed by cooking (see Section 4.3.10, Table 4.1).</p>
Other animals	There are no movement restrictions on other animals on the IP or DCP, except ducks. All animals other than pigs on an IP or DCP must be kept separate from the piggery or the pigs in a manner that prevents direct contact.
Crops and grains	No restrictions on movement of crops and grains.
Movement in of:	
Susceptible pigs	Approved under permit.
People	Movement should be restricted to essential visitors only. Protective clothing, including boots, should be provided on the property for visitors.

Declared areas

Quarantine/ movement controls	Restricted area (if declared)	Control area (if declared)
Movement out of:		
Susceptible pigs	<p>No pigs from an RA should be moved to another farm unless the movement is under permit or prescribed restrictions.</p> <p>Pigs in an RA can be moved out under permit direct to an abattoir for slaughter within 4–6 hours of arrival.</p>	<p>No pigs from a CA can be moved out of the CA. However, the CA will be established such that abattoir or slaughter facilities will be located within it. Pigs can be moved, under permit, within the CA for slaughter.</p> <p>Other movements within a CA are permitted, provided that the herds of origin are tested negative at a statistically significant level (Section 7).</p>
Movement into and within of:		
Susceptible pigs	Restrictions depend on the selected strategy for control. For example, pigs from infected sow herds could be moved to infected grow-out facilities in an RA.	Pigs can be moved into a CA for slaughter, for breeding and for management purposes. Within the CA, pigs can be moved from farm to farm, subject to a seronegative test on a statistically significant sample of the group (see Section 7).
Movement through of:		
Susceptible pigs	Pigs can move through a declared area under permit.	Pigs can move through a declared area under permit.
Movement of specified products	Movement of semen banned.	Semen from pigs in a CA can be moved out if the herd has been tested negative.
Movement of people	Biosecurity arrangements enforced.	Biosecurity arrangements enforced.
Movement of vehicles and equipment	No restriction (subject to effective cleaning and disinfection).	No restriction (subject to effective cleaning and disinfection).

Notes:

1. Approval for pig movements under permit only.
2. All pigs to be consigned directly to an approved abattoir for slaughter within 4–6 hours.
3. Multiple consignments per truck will be prohibited unless by special approval from the local disease control centre controller, subject to:
 - a. the IP or DCP being the last pick-up
 - b. the whole consignment being for immediate slaughter (within 4 hours of arrival)

- c. the truck being cleaned and disinfected to the satisfaction of a meat inspector at the abattoir; and
- d. no movements being allowed to saleyards or to other properties.

Example scenarios

1	An infected breeder farm wants to supply pigs to a linked grow-out facility within the RA until all pregnant sows have farrowed, and infected and exposed progeny have been slaughtered.	Approved
2	An infected grow-out farm wants to ship pigs to an abattoir in the same CA.	Approved
3	An infected farm wants to ship pigs to an abattoir outside the CA.	Not approved because this would risk spread of the disease. The CA has been designed with the purpose of providing farms with practical access to abattoirs.
4	A breeding company multiplier in a CA wants to ship pigs or semen to customers outside the CA.	Approved subject to seronegative test on the herd within 60 days.
5	A breeding company in an RA wants to ship pigs to customers outside the area.	Approved subject to a 30-day seronegative test on a statistically significant sample of the herd or regular kill at slaughter (Section 7) and all the pigs in the shipment, and a regular 30-day seronegative test on all the pigs in the artificial insemination program if artificial insemination was used. The shipment of semen from the RA is banned.
6	A producer wants to move early weaned pigs from an RA to a second-stage farm outside the CA.	Approved subject to a seronegative test on the herd of origin.
7	A clean farm wants to send pigs for finishing to an infected herd within the same management group and so prolong the life of the grow-out population.	Not approved because this movement would add to an infective burden already present in the herd and the immediate area and also increase the duration of infection on the farm.
8	A clean farm wants to send pigs to an infected farm in an RA as part of a supply arrangement.	Not recommended because of the adverse consequences for performance of the susceptible pigs, but may be unavoidable due to management and housing considerations.

7

Surveillance and proof of freedom

7.1 Surveillance

In farrow-to-finish facilities, the presence or absence of clinical signs of the disease needs to be ascertained. As confirmation, serum samples must test negative.

In units with only fattener pigs, serological testing is the only way to confirm freedom from PRRS.

7.2 Proof of freedom

Proof of freedom relies on serological evidence of freedom, resulting from a valid national survey.

Sample sizes should be adequate to detect a 1% prevalence with 95% confidence, as shown in Table 7.1.

Table 7.1. Sample sizes required to detect PRRS-infected pigs at 1% prevalence with 95% confidence

8 week pre-slaughter population	Sample size	8 week pre-slaughter population	Sample size
20	20	500	225
50	50	600	235
70	70	700	243
100	96	800	249
120	111	900	254
160	136	1000	258
180	146	2000	277
200	155	3000	284
300	189	4000	288
400	211	5000	290

Example: The expected number of positives is at least 1%. The population size is 190; use 200. 155 pigs must be tested.

Sentinel animals (ideally 20–40 weaner pigs) must be seronegative.

A1

Appendix 1

PORCINE REPRODUCTIVE AND RESPIRATORY SYNDROME FACT SHEET

Disease and cause

Porcine reproductive and respiratory syndrome (PRRS) is a viral disease of pigs that is characterised by late-term abortions, stillborn and weak pigs, severe respiratory disease, and high death rates in suckling and weaned pigs. The disease is caused by an RNA *Arterivirus* and has been responsible for serious economic and production losses overseas.

Occurrence in Australia

There have been no outbreaks of PRRS in Australia.

Species affected

PRRS is not a zoonotic disease.

Mallard ducks have been shown experimentally to be capable of excreting PRRS virus in their faeces, but their role in the spread of the disease in pigs is uncertain. (Zimmerman et al 1997).

PRRS only affects domestic and feral pigs. There are no known human health risks associated with eating meat and pork products from affected animals.

Key signs

Experimentally, the incubation period for individual animals is 4–8 days (Geering et al 1995), but signs may take longer to emerge in a herd. For example, reproductive failure may not occur for 25 days after infection. For the purpose of this manual, the World Organisation for Animal Health (WOAH) incubation period of 14 days is used

Clinical signs of PRRS vary with the strain of virus and the immune status of the herd, and infection may also be asymptomatic.

Acute infection in adult pigs can have a number of clinical signs including reduced appetite, fever, laboured breathing, loss of balance (ataxia), and premature farrowing or abortion. In litters, clinical signs include mummified or stillborn pigs, chemosis, and high pre-weaning mortality. In weaned pigs, clinical signs include lethargy, respiratory distress, rough hair coats and loss of appetite, and concurrent infection with other microorganisms and high mortality rates are common.

It can be difficult to differentiate the respiratory and post-weaning form of the disease from swine influenza, enzootic pneumonia, porcine respiratory coronavirus and Nipah virus infection, and laboratory testing may be required to diagnose the disease.

Spread

PRRS virus is spread most easily by direct contact, and transmission can be by inhalation, ingestion, coitus, needles or possibly bite wounds. There is also evidence to suggest that the virus can be spread by aerosol and by feeding pigs infected meat.

The virus does not persist in the environment or survive on fomites under dry conditions.

Feral pigs can become an important reservoir for the virus, and may lead to secondary spread to domestic piggeries. Control practices involve strict biosecurity management, with perimeter fencing to prevent direct contact.

Persistence of the agent

PRRS virus can survive in water for 11 days, but cannot withstand drying, so is unlikely to survive in the environment for extended periods (Benfield et al 1999a). The virus remains viable when frozen in cell culture, but levels decrease with cooling, hardening and freeing. The virus is inactivated by heat and drying out.

Glossary

Disease-specific terms

All-in-all-out production	A method of production in which all stock leave the premises (or area), followed by total restocking.
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Standard AUSVETPLAN terms

Animal	
- captive wildlife	Assessed negative (AN) is a qualifier that may be applied to ARPs, PORs, SPs, TP, DCPs or DCPFs. The qualifier may be applied following surveillance, epidemiological investigation, and/or laboratory assessment/diagnostic testing and indicates that the premises is assessed as negative at the time of classification.
- domestic animal	An animal that has been tamed and lives under human supervision and control to serve a purpose – especially a member of those species that have, through selective breeding, become notably different from their wild ancestors.
- feral animal	A previously domesticated animal that now does not live under human supervision or control.
- wildlife/wild animal	A previously domesticated animal that now does not live under human supervision or control.
Animal byproducts	Products of animal origin that are not for consumption but are destined for industrial use (eg hides and skins, fur, wool, hair, feathers, hoofs, bones, fertiliser).

Cont'd

Animal Health Committee	<p>A committee whose members are the chief veterinary officers of the Commonwealth, states and territories, along with representatives from the CSIRO Australian Centre for Disease Preparedness (CSIRO-ACDP) and the Australian Government Department of Agriculture, Fisheries and Forestry. There are also observers from Animal Health Australia, Wildlife Health Australia, and the New Zealand Ministry for Primary Industries. The committee provides advice to the National Biosecurity Committee on animal health matters, focusing on technical issues and regulatory policy.</p> <p><i>See also</i> National Biosecurity Committee</p>
Animal products	<p>Meat, meat products and other products of animal origin (eg eggs, milk) for human consumption or for use in animal feedstuff.</p>
Approved disposal site	<p>A premises that has zero susceptible livestock and has been approved as a disposal site for animal carcasses, or potentially contaminated animal products, wastes or things.</p>
Approved processing facility	<p>An abattoir, knackery, milk processing plant or other such facility that maintains increased biosecurity standards. Such a facility could have animals or animal products introduced from lower-risk premises under a permit for processing to an approved standard.</p>
At-risk premises	<p>A premises in a restricted area that contains a live susceptible animal(s) but is not considered at the time of classification to be an infected premises, dangerous contact premises, dangerous contact processing facility, suspect premises or trace premises.</p>
Australian Chief Veterinary Officer	<p>The nominated senior veterinarian in the Australian Government Department of Agriculture, Fisheries and Forestry who manages international animal health commitments and the Australian Government's response to an animal disease outbreak.</p> <p><i>See also</i> Chief veterinary officer</p>
AUSVETPLAN	<p>Australian Veterinary Emergency Plan. Nationally agreed resources that guide decision making in the response to emergency animal diseases (EADs). It outlines Australia's preferred approach to responding to EADs of national significance, and supports efficient, effective and coherent responses to these diseases.</p>
Carcase	<p>The body of an animal slaughtered for food.</p>
Carcass	<p>The body of an animal that died in the field.</p>

Cont'd

Case fatality rate	The proportion of infected animals that die of the disease among all animals diagnosed with the disease at the time.
Chief veterinary officer (CVO)	<p>The senior veterinarian of the animal health authority in each jurisdiction (national, state or territory) who has responsibility for animal disease control in that jurisdiction.</p> <p><i>See also</i> Australian Chief Veterinary Officer</p>
Compartmentalisation	The process of defining, implementing and maintaining one or more disease-free establishments under a common biosecurity management system in accordance with WOAHP guidelines, based on applied biosecurity measures and surveillance, to facilitate disease control and/or trade.
Compensation	<p>The sum of money paid by government to an owner for livestock or property that are destroyed for the purpose of eradication or prevention of the spread of an emergency animal disease, and livestock that have died of the emergency animal disease.</p> <p><i>See also</i> Cost-sharing arrangements, Emergency Animal Disease Response Agreement</p>
Consultative Committee on Emergency Animal Diseases (CCEAD)	The key technical coordinating body for animal health emergencies. Members are state and territory chief veterinary officers, representatives of CSIRO-ACDP and the relevant industries, and the Australian Chief Veterinary Officer as chair.
Control area (CA)	A legally declared area where the disease controls, including surveillance and movement controls, applied are of lesser intensity than those in a restricted area (the limits of a control area and the conditions applying to it can be varied during an incident according to need).
Cost-sharing arrangements	<p>Arrangements agreed between governments (national and state/territory) and livestock industries for sharing the costs of emergency animal disease responses.</p> <p><i>See also</i> Compensation, Emergency Animal Disease Response Agreement</p>
Dangerous contact animal	A susceptible animal that has been designated as being exposed to other infected animals or potentially infectious products following tracing and epidemiological investigation.

Cont'd

Dangerous contact premises (DCP)	A premises, apart from an abattoir, knackery or milk processing plant (or other such facility) that, after investigation and based on a risk assessment, is considered to contain a susceptible animal(s) not showing clinical signs, but considered highly likely to contain an infected animal(s) and/or contaminated animal products, wastes or things that present an unacceptable risk to the response if the risk is not addressed, and that therefore requires action to address the risk.
Dangerous contact processing facility (DCPF)	An abattoir, knackery, milk processing plant or other such facility that, based on a risk assessment, appears highly likely to have received infected animals, or contaminated animal products, wastes or things, and that requires action to address the risk.
Declared area	A defined tract of land that is subjected to disease control restrictions under emergency animal disease legislation. There are two types of declared areas: restricted area and control area.
Decontamination	Includes all stages of cleaning and disinfection.
Depopulation	The removal of a host population from a particular area to control or prevent the spread of disease.
Destroy (animals)	To kill animals humanely.
Disease agent	A general term for a transmissible organism or other factor that causes an infectious disease.
Disease Watch Hotline	24-hour freecall service for reporting suspected incidences of exotic diseases – 1800 675 888.
Disinfectant	A chemical used to destroy disease agents outside a living animal.
Disinfection	The application, after thorough cleansing, of procedures intended to destroy the infectious or parasitic agents of animal diseases, including zoonoses; applies to premises, vehicles and different objects that may have been directly or indirectly contaminated.
Disinsectisation	The destruction of insect pests, usually with a chemical agent.
Disposal	Sanitary removal of animal carcasses, animal products, materials and wastes by burial, burning or some other process so as to prevent the spread of disease.

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Emergency animal disease	<p>A disease that is (a) exotic to Australia or (b) a variant of an endemic disease or (c) a serious infectious disease of unknown or uncertain cause or (d) a severe outbreak of a known endemic disease, and that is considered to be of national significance with serious social or trade implications.</p> <p><i>See also</i> Endemic animal disease, Exotic animal disease</p>
Emergency Animal Disease Response Agreement	<p>Agreement between the Australian and state/territory governments and livestock industries on the management of emergency animal disease responses. Provisions include participatory decision making, risk management, cost sharing, the use of appropriately trained personnel and existing standards such as AUSVETPLAN.</p> <p><i>See also</i> Compensation, Cost-sharing arrangements</p>
Endemic animal disease	<p>A disease affecting animals (which may include humans) that is known to occur in Australia.</p> <p><i>See also</i> Emergency animal disease, Exotic animal disease</p>
Enterprise	<i>See</i> Risk enterprise
Enzyme-linked immunosorbent assay (ELISA)	<p>A serological test designed to detect and measure the presence of antibody or antigen in a sample. The test uses an enzyme reaction with a substrate to produce a colour change when antigen–antibody binding occurs.</p>
Epidemiological investigation	<p>An investigation to identify and qualify the risk factors associated with the disease.</p> <p><i>See also</i> Veterinary investigation</p>
Epidemiology	<p>The study of disease in populations and of factors that determine its occurrence.</p>
Exotic animal disease	<p>A disease affecting animals (which may include humans) that does not normally occur in Australia.</p> <p><i>See also</i> Emergency animal disease, Endemic animal disease</p>
Exotic fauna/feral animals	<i>See</i> Wild animals
Fomites	<p>Inanimate objects (eg boots, clothing, equipment, instruments, vehicles, crates, packaging) that can carry an infectious disease agent and may spread the disease through mechanical transmission.</p>

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General permit	<p>A legal document that describes the requirements for movement of an animal (or group of animals), commodity or thing, for which permission may be granted without the need for direct interaction between the person moving the animal(s), commodity or thing and a government veterinarian or inspector. The permit may be completed via a webpage or in an approved place (such as a government office or commercial premises). A printed version of the permit must accompany the movement. The permit may impose preconditions and/or restrictions on movements.</p> <p><i>See also</i> Special permit</p>
In-contact animals	<p>Animals that have had close contact with infected animals, such as noninfected animals in the same group as infected animals.</p>
Incubation period	<p>The period that elapses between the introduction of a pathogen into an animal and the first clinical signs of the disease.</p>
Index case	
– for the outbreak	<p>The first case of the disease to be diagnosed in a disease outbreak.</p> <p><i>See also</i> Index property</p>
– for a herd, flock or other defined group	<p>The first diagnosed case of an outbreak in a herd, flock or other defined group.</p>
Infected premises (IP)	<p>A defined area (which may be all or part of a property) on which animals meeting the case definition are or were present, or the causative agent of the emergency animal disease is present, or there is a reasonable suspicion that either is present, and that the relevant chief veterinary officer or their delegate has declared to be an infected premises.</p>
Local control centre	<p>An emergency operations centre responsible for the command and control of field operations in a defined area.</p>
Monitoring	<p>Routine collection of data for assessing the health status of a population or the level of contamination of a site for remediation purposes.</p> <p><i>See also</i> Surveillance</p>
Movement control	<p>Restrictions placed on the movement of animals, people and other things to prevent the spread of disease.</p>

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National Biosecurity Committee	A committee that was formally established under the Intergovernmental Agreement on Biosecurity (IGAB). The IGAB was signed on 13 January 2012, and signatories include all states and territories except Tasmania. The committee provides advice to the Agriculture Senior Officials Committee and the Agriculture Ministers' Forum on national biosecurity issues, and on the IGAB.
National Management Group (NMG)	A group established to approve (or not approve) the invoking of cost sharing under the Emergency Animal Disease Response Agreement. NMG members are the Secretary of the Australian Government Department of Agriculture, Fisheries and Forestry as chair, the chief executive officers of the state and territory government parties, and the president (or analogous officer) of each of the relevant industry parties.
Native wildlife	See Wild animals
Operational procedures	Detailed instructions for carrying out specific disease control activities, such as disposal, destruction, decontamination and valuation.
Outside area (OA)	The area of Australia outside the declared (control and restricted) areas.
Owner	Person responsible for a premises (includes an agent of the owner, such as a manager or other controlling officer).
Polymerase chain reaction (PCR)	A method of amplifying and analysing DNA sequences that can be used to detect the presence of viral DNA.
Premises	A tract of land including its buildings, or a separate farm or facility that is maintained by a single set of services and personnel.
Premises of relevance (POR)	A premises in a control area that contains a live susceptible animal(s) but is not considered at the time of classification to be an infected premises, suspect premises, trace premises, dangerous contact premises or dangerous contact processing facility.
Prevalence	The proportion (or percentage) of animals in a particular population affected by a particular disease (or infection or positive antibody titre) at a given point in time.
Primary case	The individual that introduces disease into a herd, flock or other group under study. Not necessarily the first case diagnosed case in that herd, flock or other group under study.

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Proof of freedom	Reaching a point following an outbreak and post-outbreak surveillance when freedom from the disease can be claimed with a reasonable level of statistical confidence.
Qualifiers	
– assessed negative	Assessed negative (AN) is a qualifier that may be applied to ARPs, PORs, SPs, TP, DCPs or DCPFs. The qualifier may be applied following surveillance, epidemiological investigation, and/or laboratory assessment/diagnostic testing and indicates that the premises is assessed as negative at the time of classification.
– sentinels on site	Sentinels on site (SN) is a qualifier that may be applied to IPs and DCPs to indicate that sentinel animals are present on the premises as part of response activities (ie before it can be assessed as an RP).
– vaccinated	The vaccinated (VN) qualifier can be applied in a number of different ways. At its most basic level, it can be used to identify premises that contain susceptible animals that have been vaccinated against the EAD in question. However, depending on the legislation, objectives and processes within a jurisdiction, the VN qualifier may be used to track a range of criteria and parameters.
Quarantine	Legally enforceable requirement that prevents or minimises spread of pests and disease agents by controlling the movement of animals, persons or things.
Resolved premises (RP)	An infected premises, dangerous contact premises or dangerous contact processing facility that has completed the required control measures, and is subject to the procedures and restrictions appropriate to the area in which it is located.
Restricted area (RA)	A relatively small legally declared area around infected premises and dangerous contact premises that is subject to disease controls, including intense surveillance and movement controls.
Risk enterprise	A defined livestock or related enterprise that is potentially a major source of infection for many other premises. Includes intensive piggeries, feedlots, abattoirs, knackeries, saleyards, calf scales, milk factories, tanneries, skin sheds, game meat establishments, cold stores, artificial insemination centres, veterinary laboratories and hospitals, road and rail freight depots, showgrounds, field days, weighbridges and garbage depots.

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Sensitivity	The proportion of truly positive units that are correctly identified as positive by a test. <i>See also</i> Specificity
Sentinel animal	Animal of known health status that is monitored to detect the presence of a specific disease agent.
Seroconversion	The appearance in the blood serum of antibodies (as determined by a serology test) following vaccination or natural exposure to a disease agent.
Serosurveillance	Surveillance of an animal population by testing serum samples for the presence of antibodies to disease agents.
Serotype	A subgroup of microorganisms identified by the antigens carried (as determined by a serology test).
Serum neutralisation test	A serological test to detect and measure the presence of antibody in a sample. Antibody in serum is serially diluted to detect the highest dilution that neutralises a standard amount of antigen. The neutralising antibody titre is given as the reciprocal of this dilution.
Slaughter	The humane killing of an animal for meat for human consumption.
Special permit	A legal document that describes the requirements for movement of an animal (or group of animals), commodity or thing, for which the person moving the animal(s), commodity or thing must obtain prior written permission from the relevant government veterinarian or inspector. A printed version of the permit must accompany the movement. The permit may impose preconditions and/or restrictions on movements. <i>See also</i> General permit
Specificity	The proportion of truly negative units that are correctly identified as negative by a test. <i>See also</i> Sensitivity
Stamping out	The strategy of eliminating infection from premises through the destruction of animals in accordance with the particular AUSVETPLAN manual, and in a manner that permits appropriate disposal of carcasses and decontamination of the site.
State coordination centre	The emergency operations centre that directs the disease control operations to be undertaken in a state or territory.

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Surveillance	A systematic program of investigation designed to establish the presence, extent or absence of a disease, or of infection or contamination with the causative organism. It includes the examination of animals for clinical signs, antibodies or the causative organism.
Susceptible animals	Animals that can be infected with a particular disease.
Suspect animal	<p>An animal that may have been exposed to an emergency disease such that its quarantine and intensive surveillance, but not pre-emptive slaughter, is warranted.</p> <p>or</p> <p>An animal not known to have been exposed to a disease agent but showing clinical signs requiring differential diagnosis.</p>
Suspect premises (SP)	Temporary classification of a premises that contains a susceptible animal(s) not known to have been exposed to the disease agent but showing clinical signs similar to the case definition, and that therefore requires investigation(s).

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Swill Also known as ‘prohibited pig feed’, means material of mammalian origin, or any substance that has come in contact with this material, but does not include:

- i. milk, milk products or milk byproducts either of Australian provenance or legally imported for stockfeed use into Australia
- ii. material containing flesh, bones, blood, offal or mammal carcasses that is treated by an approved process¹
- iii. a carcass or part of a domestic pig, born and raised on the property on which the pig or pigs that are administered the part are held, that is administered for therapeutic purposes in accordance with the written instructions of a veterinary practitioner.
- iv. material used under an individual and defined-period permit issued by a jurisdiction for the purposes of research or baiting.

¹ In terms of (ii), approved processes are:

- 1. rendering in accordance with the Australian Standard for the Hygienic Rendering of Animal Products
- 2. under jurisdictional permit, cooking processes subject to compliance verification that ensure that a core temperature of at least 100 °C for a minimum of 30 minutes, or equivalent, has been reached
- 3. treatment of cooking oil, which has been used for cooking in Australia, in accordance with the National Standard for Recycling of Used Cooking Fats and Oils Intended for Animal Feeds
- 4. under jurisdictional permit, any other nationally agreed process approved by AHC for which an acceptable risk assessment has been undertaken and that is subject to compliance verification.

The national definition is a minimum standard. Some jurisdictions have additional conditions for swill feeding that pig producers in those jurisdictions must comply with, over and above the requirements of the national definition.

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Swill feeding	<p>Also known as 'feeding prohibited pig feed', it includes:</p> <ul style="list-style-type: none"> • feeding, or allowing or directing another person to feed, prohibited pig feed to a pig • allowing a pig to have access to prohibited pig feed • the collection and storage or possession of prohibited pig feed on a premises where one or more pigs are kept • supplying to another person prohibited pig feed that the supplier knows is for feeding to any pig. <p>This definition was endorsed by the Agriculture Ministers' Council through AGMIN OOS 04/2014.</p>
Trace premises (TP)	Temporary classification of a premises that contains susceptible animal(s) that tracing indicates may have been exposed to the disease agent, or contains contaminated animal products, wastes or things, and that requires investigation(s).
Tracing	The process of locating animals, people or other items that may be implicated in the spread of disease, so that appropriate action can be taken.
Unknown status premises (UP)	A premises within a declared area where the current presence of susceptible animals and/or risk products, wastes or things is unknown.
Vaccination	Inoculation of individuals with a vaccine to provide active immunity.
Vaccine	A substance used to stimulate immunity against one or several disease-causing agents to provide protection or to reduce the effects of the disease. A vaccine is prepared from the causative agent of a disease, its products or a synthetic substitute, which is treated to act as an antigen without inducing the disease.
– adjuvanted	A vaccine in which one or several disease-causing agents are combined with an adjuvant (a substance that increases the immune response).
– attenuated	A vaccine prepared from infective or 'live' microbes that are less pathogenic but retain their ability to induce protective immunity.
– gene deleted	An attenuated or inactivated vaccine in which genes for non-essential surface glycoproteins have been removed by genetic engineering. This provides a useful immunological marker for the vaccine virus compared with the wild virus.
– inactivated	A vaccine prepared from a virus that has been inactivated ('killed') by chemical or physical treatment.

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– recombinant	A vaccine produced from virus that has been genetically engineered to contain only selected genes, including those causing the immunogenic effect.
Vector	A living organism (frequently an arthropod) that transmits an infectious agent from one host to another. A <i>biological</i> vector is one in which the infectious agent must develop or multiply before becoming infective to a recipient host. A <i>mechanical</i> vector is one that transmits an infectious agent from one host to another but is not essential to the lifecycle of the agent.
Veterinary investigation	An investigation of the diagnosis, pathology and epidemiology of the disease. See also Epidemiological investigation
Viraemia	The presence of viruses in the blood.
Wild animals	
– native wildlife	Animals that are indigenous to Australia and may be susceptible to emergency animal diseases (eg bats, dingoes, marsupials).
– feral animals	Animals of domestic species that are not confined or under control (eg cats, horses, pigs).
– exotic fauna	Nondomestic animal species that are not indigenous to Australia (eg foxes).
WOAH Terrestrial Code	WOAH <i>Terrestrial Animal Health Code</i> . Describes standards for safe international trade in animals and animal products. Revised annually and published on the internet at: www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access .
WOAH Terrestrial Manual	WOAH <i>Manual of diagnostic tests and vaccines for terrestrial animals</i> . Describes standards for laboratory diagnostic tests, and the production and control of biological products (principally vaccines). The current edition is published on the internet at: www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-manual-online-access .
Wool	Sheep wool.
Zero susceptible species premises (ZP)	A premises that does not contain any susceptible animals or risk products, wastes or things.
Zoning	The process of defining, implementing and maintaining a disease-free or infected area in accordance with WOAH guidelines, based on geopolitical and/or physical boundaries and surveillance, to facilitate disease control and/or trade.
Zoonosis	A disease of animals that can be transmitted to humans.

Abbreviations

Standard AUSVETPLAN abbreviations

ACDP	Australian Centre for Disease Preparedness
AN	assessed negative
ARP	at-risk premises
AUSVETPLAN	Australian Veterinary Emergency Plan
CA	control area
CCEAD	Consultative Committee on Emergency Animal Diseases
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CVO	chief veterinary officer
DCP	dangerous contact premises
DCPF	dangerous contact processing facility
EAD	emergency animal disease
EADRA	Emergency Animal Disease Response Agreement
EADRP	Emergency Animal Disease Response Plan
EDTA	ethylenediaminetetraacetic acid (anticoagulant for whole blood)
ELISA	enzyme-linked immunosorbent assay
GP	general permit
IETS	International Embryo Technology Society
IP	infected premises

Cont'd

LCC	local control centre
NMG	National Management Group
OA	outside area
PCR	polymerase chain reaction
POR	premises of relevance
RA	restricted area
RP	resolved premises
SCC	state coordination centre
SP	suspect premises
SpP	special permit
TP	trace premises
UP	unknown status premises
WOAH	World Organisation for Animal Health (founded as OIE)
ZP	zero susceptible species premises

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