AUSTRALIAN VETERINARY EMERGENCY PLAN

AUSVETPLAN

Enterprise Manual

Pork industry

Version 5.0

AUSVETPLAN is a series of technical response plans that describe the proposed Australian approach to an emergency animal disease incident. The documents provide guidance based on sound analysis, linking policy, strategies, implementation, coordination and emergency-management plans.

National Biosecurity Committee

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ISBN 0 642 24506 1 (printed version)

ISBN 1 876 71438 7 (electronic version)

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Approved citation

Animal Health Australia (2021). *Enterprise manual*: *Pork industry* (version 5.0). Australian Veterinary Emergency Plan (AUSVETPLAN), edition 5, Canberra, ACT.

EMERGENCY ANIMAL DISEASE WATCH HOTLINE: 1800 675 888

The Emergency Animal Disease Watch Hotline is a toll-free telephone number that connects callers to the relevant state or territory officer to report concerns about any potential emergency disease situation. Anyone suspecting an emergency disease outbreak should use this number to get immediate advice and assistance.

Publication record

Edition 3
Version 3.0, 2011 (new manual)

Edition 5
Version 5.0, 2021 (major update and new format)

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1 Introduction

1.1 This manual

1.1.1 Purpose

Enterprise manuals address the risks associated with so-called risk enterprises. These are defined as livestock or related enterprises that are a potential source of major infection for many other premises, and can thus increase the potential size of an outbreak and affect its nature.

1.1.2 Scope

This enterprise manual is aimed at both government officers and pork industry personnel who may be involved in emergency animal disease (EAD) preparedness and response. For government personnel, including those not familiar with the industry, the manual brings together, from many sources, operational guidelines, plans of action and other resources for dealing with EADs. For industry personnel, including owners or managers, the manual provides guidelines on their responsibilities during an EAD outbreak, as required by the relevant government authorities, and strategies that may be adopted to improve preparedness for, or to handle, a suspected EAD. Managers should include elements of this manual in the operational manuals of their enterprises.

1.1.3 Development

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 enterprise manual should be read and implemented in conjunction with:

- other AUSVETPLAN documents, including response strategies, and operational and management manuals; and any relevant guidance and resource documents. The complete series of manuals is available on the Animal Health Australia website[1]
- 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 EAD incidents and emergencies

[1] www.animalhealthaustralia.com.au/ausvetplan/
[2] www.animalhealthaustralia.com.au/nationally-agreed-standard-operating-procedures/

- 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 – EADRA[3]), where applicable.

1.3 Training resources

EAD preparedness and response arrangements in Australia

The EAD Foundation online course[4] provides livestock producers, veterinarians, veterinary students, government personnel and emergency workers with foundation knowledge for further training in EAD preparedness and response in Australia.

1.3.1 Industry-specific training

Australian Pork Limited (APL) and industry training providers support a wide range of training programs and materials, and subsidise their use by pork producers. These materials are continually updated by APL and communicated to industry members and the public as more information and resources become available. Publications, videos and programs relevant to the control of diseases include:

- a booklet about antemortem examinations, to train producers to perform an antemortem as a component of on-farm quality assurance[5]
- *Care of the compromised pig*,[6] a manual that provides strategies and guidance for producers to use in the care and management of sick pigs
- *Pig biosecurity management plan*,[7] which explains the key elements involved in a piggery biosecurity plan
- *Eradicating diseases of pigs*, which provides proven strategies for producers to eradicate a range of important endemic pig diseases
- *Pathology of the pig: a diagnostic guide* (Sims & Glastonbury 1996), a practical guide for anyone who performs postmortem examinations on pigs
- a series of guides for each production stage, including
  - *The good health manual*, which helps producers meet global best practice in production, and identify pig health problems, and their causes and treatments
  - *Piggery manure and effluent management and reuse guidelines*, to ensure operational sustainability
- *Preparing your business to survive an emergency animal disease outbreak: a 30-minute plan for piggeries*,[8] a planning tool that assists producers to develop an EAD survival plan
- biosecurity elements available online[9]
- Meat Industry Training Advisory Council training on African swine fever for meat inspectors.[10]

[3] https://animalhealthaustralia.com.au/eadra/
[4] https://animalhealthaustralia.com.au/online-training-courses/
[5] Available from APL on request
[6] https://australianpork.com.au/sites/default/files/2021-06/Care_of_the_compromised_pig.pdf
[7] www.farmbiosecurity.com.au/wp-content/uploads/2021/08/Pig-BMP_Checklist_PRINT-PDF.pdf
[8] www.australianpork.com.au/sites/default/files/2021-06/Preparing-your-busines-to-survive-an-EAD-30-minute-piggery-plan.pdf
[9] https://australianpork.com.au/industry-focus/biosecurity
[10] https://www.mintrac.com.au/page.asp?p=178

In addition to these elements, piggeries certified under the Australian Pork Industry Quality Assurance Program (APIQ✓®) must provide suitable staff training and maintain appropriate training records. State animal welfare regulations also require people responsible for pigs to be considered 'competent' to perform their role, or be supervised by someone who is considered competent, as specified in the *Model code of practice for the welfare of animals: pigs*[11] and state requirements. This requires pig producers to complete training, or achieve recognition of prior learning, in at least the following areas:

- moving and handling pigs
- inspecting and assessing the health and wellbeing of pigs
- carrying out vaccinations, health treatments and elective husbandry procedures
- performing humane destruction of pigs suffering an incurable disease, untreatable injury or painful deformity
- maintaining records of inspections and assessments of pigs
- performing euthanasia (this is an optional unit).

Piggery employees are trained to recognise the normal appearance and behaviour of pigs, and the normal production parameters of the farm, so that they can recognise any abnormality or change. They are also trained in biosecurity and disease recognition, including how to recognise the main signs of key pig EADs and the risks these diseases pose. Many staff members have tertiary qualifications in animal science, agriculture or veterinary medicine. Vocational training is common, including the Pork Industry Stockperson Skillset, Certificate III in Pork Production and Diploma of Pork Production. To address domestic labour shortages, the Australian pork industry relies on skilled migrant workers employed predominantly using the Pork Industry Labour Agreement, with a high representation from the Philippines.

APL works with Animal Health Australia and registered training organisations to ensure that piggery employees are trained in the skills required to plan, implement and manage an effective property-based work health and safety program. A module of the Certificate III in Pork Production provides specific training in animal health para-veterinary care.

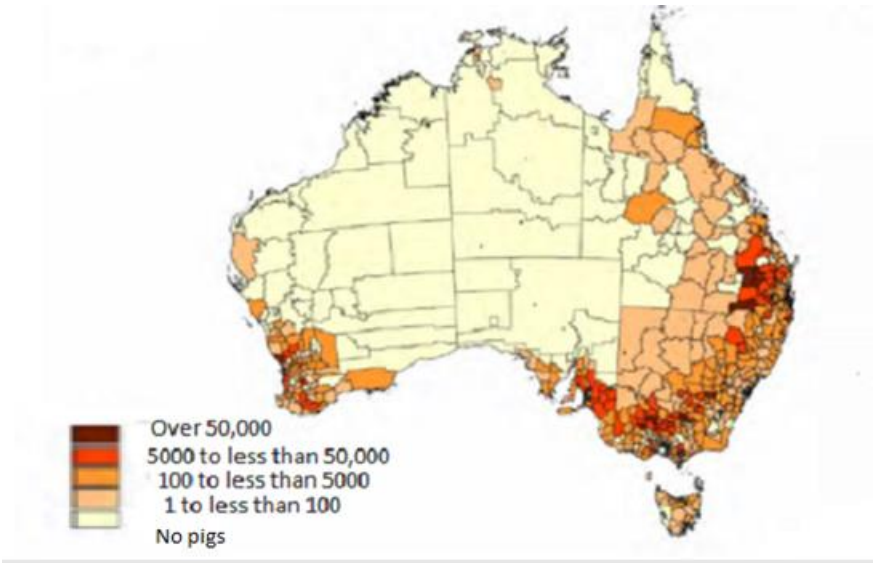
[11] www.publish.csiro.au/book/5698/

2 The Australian industry

The size and geographical distribution of the pork industry across Australia vary according to a range of factors, including climate, the availability and price of feed, access to markets, the size and nature of imports of pork, currency fluctuations, and competition from other meat products.

The pork industry contributes $5.2 billion to the Australian economy and supports 36 000 jobs (APL 2017). The gross value of production of the Australian pork industry in the 2018–19 financial year was approximately $1180 million (APL 2019).

The geographical distribution of domestic pigs in Australia is presented in Figure 2.1.



Source: APL (2012)

Figure 2.1 Distribution of domestic pigs in Australia

Environmental considerations are important in the location of piggeries. Most piggeries are in areas that are close to feed supplies (either grown on-site or purchased) or feedmills, and to processing plants. Their proximity to towns, dwellings, roads, and rivers or waterways is restricted by jurisdictional environmental legislation.

In 2018–19, Australian Pork Limited (APL) reported 3764 registered pig sites that held an estimated 274 000 sows or a total pig inventory of 2.3 million (ABARES 2020). In 2012 (the last published dataset), the sow herds in each state were Queensland (63 000), New South Wales (56 000), Victoria (56 000), South Australia (50 000), Western Australia (38 000) and Tasmania (1600). Nationally, there are about 50–60 farms with more than 1000 sows. These 2.5% of pig farms account for about 47% of production.

Approximately 90% of pigs are slaughtered at seven export abattoirs across Australia. The remaining 10% of pigs are slaughtered at a large number of small, mostly multispecies, domestic abattoirs – for sale only into the domestic Australian market.

Pigs are slaughtered to produce chilled, frozen and cured products, including whole carcases, specific cuts and further processed products. Finished products may be stored chilled or frozen on the processing site, or may be transported from the site to markets or for further processing. Frozen products may be stored for longer, but all product moves to market very quickly because of the structure of the industry.

Pigmeat imports have grown significantly over the past 20 years as amended quarantine arrangements (in line with Australia's commitments under the World Trade Organization Agreement on Sanitary and Phytosanitary Measures) have allowed imports to be sourced from more international suppliers. Under current arrangements, all imported pigmeat must be used in the processed meat market. Imports account for about 50% of the pigmeat supply.

2.1 Industry operations

2.1.1 Structure

The term 'piggery complex' or 'pig production area' is sometimes used to include:

- all buildings or paddocks where pigs live
- adjoining or nearby areas where pigs are yarded, tended, loaded and unloaded
- adjacent areas where piggery byproducts are accumulated or treated, pending on-site use or transport off-site
- areas where pig feeding facilities are maintained, or areas where feed is stored, handled or prepared (including feedmills).

A piggery complex itself does not include any areas of land where byproducts such as effluent, pond sludge or separated solids are applied, unless it is a rotational outdoor intensive piggery.

A typical commercial piggery comprises an administration area, a feed preparation area, pig housing and a waste disposal area. Entry to a piggery should be tightly controlled. Generally, the number of entry gates is limited (usually to one), and people and vehicles cannot enter without authorisation. Records are maintained of all vehicles, people and pigs entering and leaving. All visitors are required to sign a register. Areas within the piggery complex may be designated as 'clean'[12] and 'dirty'[13] to provide a convenient way to control access. Vehicles are not allowed into areas designated as 'clean' unless necessary and authorised. If so, they are required to park as far away from pig sheds as practicable.

Ventilation is particularly important, as adequate airflow helps remove gases and airborne particles, including microorganisms. This improves air quality and reduces the risk of respiratory disease. Overcrowding, especially in hot, humid weather, lowers hygiene. It also increases susceptibility to disease, heat stress and porcine stress syndrome. More information on the importance of ventilation can be found in Section 2.1.4.

Independent of environmental conditions, a minimum amount of fresh air (depending on the number and class of animals housed) must be introduced into a building to remove water vapour, carbon dioxide, ammonia, airborne dust, bacteria and odours.

2.1.2 Stockfeed

Feed management is critical to the operation of a piggery. Strict protocols are usually in place to manage each aspect, from supply to delivery to each unit in the piggery. Generally, pigs can feed ad libitum from weaning until they reach market weight.

[12] 'Clean' areas in a piggery are where the pigs are kept, and steps are taken to maintain biosecurity in these areas.
[13] 'Dirty' areas in a piggery are essentially outside the biosecure area where the pigs are kept, and where visitors are allowed access.

Feed accounts for 55–75% of the total costs of running a piggery; thus, feeding and nutrition can have a significant impact on profits. Selecting the combination of feed ingredients that will result in optimal production at minimum cost is complex – more than 40 individual nutrients need to be considered. The feed used for pigs consists of grains as a source of energy, and protein that may be supplied in vegetable protein meals (eg soybean, sunflower, canola) or animal protein meals (eg meat, fish, blood). Vitamins and minerals are supplied as a premix that is added during mixing.

Rations may be prepared on-site from grain and forage grown on the complex. This is most common on small to medium-sized piggeries, although some large piggeries have multiple sites where grain is grown specifically for feed. Most bulk grain supplies are purchased regionally, and many loads may arrive each day on a large piggery.

In larger piggeries, rations are prepared by commercial feed merchants to the specification of the piggery and delivered either in the feed company's vehicles or by contractors. Some larger producers and integrated piggeries have their own feedmills or mix their own feed. Mixing feed on farm allows specific nutritional requirements to be catered for but is time-consuming and requires specialised equipment. An advantage of commercially prepared pelleted feeds is that they have been heat treated, which kills most microorganisms. Cross-contamination and recontamination are very real possibilities in most feedmills. It may be possible to process grain that is contaminated with an emergency animal disease (EAD) agent on-site in a way that destroys the EAD agent, so that it can be used in piggery rations.

Different diets (up to 7–10 and possibly more for larger piggeries that have infrastructure that allows simple changeover of diets) are provided for each stage of a pig's growth. The diet is progressively changed as the pigs go through weaner, grower and finisher stages. This may be a continual process, involving changing the feed (over several days to a week) by introducing an increasing proportion of the new feed, to avoid dietary disruption.

Provision of feed to pigs

In all feeding systems, the feeding method is managed to ensure that all pigs have adequate access to feed. This requires trained staff, knowledge of ingredients, and regular inspection of pigs and delivery systems. Various stressors influence voluntary feed intake; these can be classified as environmental (eg temperature, humidity, ventilation), social (eg space allocation, group size, mixing, competition) and immunological (eg disease, injury). Temperature is probably the most significant stressor. Variations in feed intake can also be attributed to genetic differences and the stage of production.

An adequate intake of colostrum is essential in the early life of the newborn piglet. Supplementary feeding (creep feeding) of piglets during suckling helps to alleviate digestive problems at weaning by allowing piglets to adjust slowly to dry feed. This is more common when piglets are weaned later than 2–3 weeks. Feeding in this way may result in greater weaning weights. Generally, the feeds comprise a small flaky pellet or moist mash that is supplied on a 'little and often' basis, with strict attention to the cleanliness of the system.

Immediately postweaning, various stressors result in poor feed intake and often a slight reduction in growth rate. Trough feeding of weaners is generally used.

Sows are fed carefully as they need adequate reserves at farrowing for milk production and successful mating after weaning. Lactating sows require both an adequate feed intake and correct diet to ensure that they produce enough milk for preweaning growth of the nursing litter. Depending on the system, they may have free access to feed or may be fed 2–3 times daily.

Each pig needs adequate access to feed; otherwise, uneven growth, poor condition and reduced welfare may result. The objective is for each pig to have adequate feeding space, separated from lying and dunging areas. Floor feeding may be used, provided that the stocking rate is appropriate, and each

pig receives sufficient feed. Wastage when floor feeding is used can be high, and sows may have greater variability in body condition because of aggression. Social aspects of floor feeding are important, as uneven feed distribution may be exploited by dominant animals.

Trough feeding is generally regarded as better than floor feeding. Dry sows housed in stalls or group pens generally have restricted feed and are fed concurrently with mechanical drop feeders or manually. Trough feeding systems must have a trough size adequate for the number of sows in the pen. The design of the trough should prevent the pigs from walking, lying, urinating or dunging in it.

Electronic feeding stations are commonly used for large groups of pigs housed with increased space. In such systems, pigs are individually identified with an electronic collar, ear tag or implant. The electronic feeding station can recognise a pig's electronic identification and provide individual allocation of the feed. This type of system requires frequent inspection to ensure that the animals are obtaining their correct allocation of feed.

Liquid feeding systems are used in some piggeries. They have several advantages, including:

- improved pig performance
- reduced feed loss, and therefore an improvement in the pig's environment
- increased accuracy of rations
- improved intakes at high ambient temperatures
- reduced feed wastage.

There may also be better environmental outcomes through a reduction in piggery effluent and improved health.

The amount of feed required for pigs in outdoor systems is generally higher than in conventional indoor systems, in part due to wastage. Provision of feed needs to be adjusted according to weather conditions, and considerable management skills may be required to manage changing nutritional requirements. Feed may be presented to outdoor pigs by hand, through mechanical feeders, ad libitum or using fixed paddock feeders that can be replenished manually.

2.1.3 Water

A continuous and substantial supply of high-quality water is essential to the operation of a piggery for the health and wellbeing of the pigs, and for cooling, cleaning and feed constitution (where liquid feeders are used). Water may be drawn from underground aquifers, surface water (eg dams and streams) or the mains supply. Some piggeries have an on-farm chlorination plant to ensure water quality.

Most piggeries use nipple drinkers rather than bowls or troughs because of the difficulty in keeping bowls or troughs clean. However, nipple drinkers can become blocked, potentially leading to dehydration of penned animals. One nipple drinker per 10 pigs is generally used for weaner and grower pigs. Average consumption is 3 L/day for weaners, 5–6 L/day for growers/finishers, 11 L/day for dry sows and 17 L/day for lactating sows. Factors such as quality, flow rate, temperature and availability can affect the amount of water consumed as well as wasted.

Water may also be provided via liquid feeding as an alternative to separate feeders and waterers. Usually a ratio of 2.5:1.0 (water:feed) is used, but this may vary. This system is popular for lactating sows, as it reduces the need for cleaning, reduces water and feed wastage, and may increase feed intake.

The water supply to a piggery must be capable of providing significantly more than the normal requirement, because, during an EAD response, large amounts of water may be needed for decontamination of vehicles, equipment and sheds.

2.1.4 Animal health

In intensive piggeries, good hygiene practices help minimise disease problems and maximise production. These depend primarily on the design of the piggery, management, pig flow, routine cleaning and disinfection, and good housekeeping.

Most piggeries employ a veterinarian (and often a pig specialist) to assist with disease control. Larger piggeries have one or more veterinarians on their staff. During an EAD outbreak, these professionally trained staff can assist with rapid diagnostic testing. A list of EADs relevant to the pork industry can be found in Appendix 1.

The farms that produce about 90% of the pigs sold each year in Australia have quarantine facilities for new breeding stock, or operate closed herds and only introduce genes by artificial insemination. Introduced stock may be held in quarantine for 1–2 months under observation by a trained staff member. Small holdings are unlikely to have a quarantine facility; although these holdings produce relatively few pigs, they comprise about 70% of the properties that carry pigs.

An isolation facility is not practical for grower–finisher farms, which regularly introduce growing pigs as part of multisite enterprises within the same epidemiological unit. All-in-all-out systems (see Section 2.1.8) provide a degree of isolation for each batch, which increases the chance that any introduced disease will remain contained for a limited period because the opportunity for direct pig-to-pig spread between groups is reduced. However, fomite and aerosol spread of EAD agents remains problematic.

Temperature and ventilation

Pigs of all ages are susceptible to temperature changes. The critical temperatures vary with the weight of the pig and the specific conditions within a piggery. Young pigs suffer most from the cold; older and larger animals succumb first to rising temperatures.

The most favourable temperature for newborn piglets is 30–35 °C. The temperature is gradually reduced so that, by the 4th week, it is maintained at 24–26 °C. Early in its life, the piglet's ability to withstand cold is limited, and losses can occur very quickly where the microclimate remains below 16 °C. Most piggeries will have thermometers and closely monitor the temperature.

Temperatures above 27 °C are considered undesirable for growers, finishers and breeders. Heat stress, porcine stress syndrome and death are all possible outcomes of poor temperature management. Pigs can control their temperature only by evaporative cooling; a mix of overcrowding and poor ventilation can be particularly difficult to manage.

There are three ways to control temperatures in piggeries:

- Ventilating (on its own) will reduce the temperature of a shed.
- Insulating the roof and walls will reduce heat gain or loss by conduction.
- Draught-proofing will reduce uncontrolled air change.

If there is sufficient air movement at the pig level, the potential for heat stress can be further reduced using drip cooling in farrowing areas and spray cooling elsewhere.

2.1.5 Production stages

Pig production can be divided into five stages (Figure 2.2):

- breeding
- gestating or dry sows
- farrowing
- weaning
- growing/finishing.

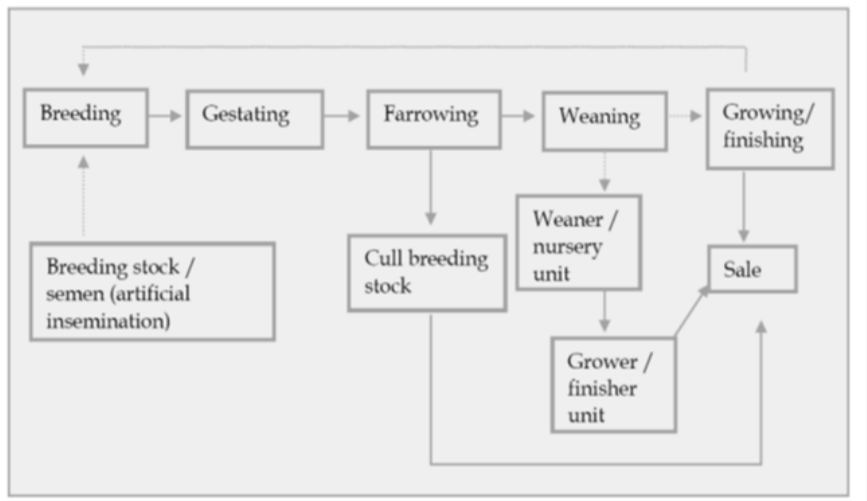


Figure 2.2 Components of the piggery production system

2.1.6 Farming systems

Individual piggeries or production units can include one or more of the lifecycle stages listed in Section 2.1.5. They can be generally described as:

- farrow-to-finish piggeries (all stages on-site)
- breeder piggeries
- weaner piggeries
- grower–finisher piggeries
- boar studs
- multisite piggeries (distributed across many sites and across more than one state); the different classes of pigs are managed separately to provide for their specific requirements.

The size of enterprises varies from small, noncommercial, 'backyard' operations to large, fully integrated operations that house tens of thousands of pigs on multiple linked sites. Most pigs are reared in intensive piggeries where there is a high degree of control over diet, environment and health status through all stages of production.

Small units generally operate a continuous farrowing system, in which sows are mated and farrowed on a weekly basis. A batch-farrowing system, in which sows are formed into groups, mated, and farrowed at set intervals, is common because it allows for an all-in-all-out production system (see Section 2.1.8). All-in-all-out husbandry methods create natural breaks, which can reduce spread of disease, and facilitate activities such as cleaning and disinfection.

The following information highlights the features of each type of piggery most relevant to the control of EADs. More detailed descriptions of the operations of each type of piggery are in Appendix 2.

Farrow-to-finish piggeries

Farrow-to-finish is the conventional type of intensive pig farm, where breeding, farrowing, weaning and growing/finishing of pigs all occur on one farm until sale, at around 18–26 weeks of age. Many farms also have quarantine facilities where incoming stock (if the farm does not breed its own replacements) are housed for a short time (usually 4–6 weeks) before they come into the herd.

Having all types of pigs in the one place, even though they may be housed separately, increases the potential for disease to spread between groups by feed or water contamination, sharing of air space, or workers who may attend to all stages of production.

On large farms, all-in-all-out systems are increasingly common. The downside of this is that several thousand pigs of the same age may share the same air space, with a consequent greater risk of more rapid disease spread.

Feed is delivered daily, weekly or monthly, depending on scale. Biosecurity associated with positioning of feed silos varies considerably. Modern farms have the silos positioned at the perimeter so there is no need for trucks and drivers to enter the farm compound. Older farms may require the feed transport to enter the farm compound.

During an EAD outbreak, there are important financial implications for pork production businesses that find themselves in a restricted or control area and unable to move pigs for several days or weeks. There is also significant potential for rapidly escalating animal welfare crises where pig movements are delayed.

Breeder piggeries

The breeder piggery is a production system in which only gilts, sows, boars and suckling piglets are farmed at the one site. Management focuses on mating, pregnancy, farrowing and weaning. After farrowing and a period of lactation (typically 3–4 weeks), piglets are weaned and sent off-site to a grower–finisher site. Every time a new group of sows is introduced to farrow, sows in the system must be weaned and their progeny moved off-site. On most farms, there is limited capacity to hold pigs for an extended period; hence stock standstill orders have a substantial impact on segmented farms.

Breeding farms are usually well isolated. In an EAD response, it may be possible to allow them to continue to operate, provided that isolation and effective biosecurity can be confirmed and maintained, and semen delivery is allowed.

Weaner piggeries

A weaner piggery includes only weaner pigs, generally from 3–4 weeks to 8–10 weeks of age. Groups of pigs are generally moved into all-in-all-out rooms or sheds each week. Some farms run on a batch basis, and the whole site is filled at the same time.

Groups of weaners may be derived from several sites, which results in mixing, and an increase in stress and disease risk. Once established, a disease can be expected to spread rapidly within a weaner group.

Grower–finisher piggeries

A grower–finisher piggery includes grower pigs (about 10–16 weeks of age) and finisher pigs (from about 16 weeks to 22–24 weeks of age). They may be housed in conventional sheds, deep-litter housing, outdoors, or a combination of these.

The preferred housing is based on all-in-all-out or batch-production systems. These have less potential for entry of a disease than a piggery with progressive arrivals.

Pigs may be moved between sheds during growth to bring together groups of similarly weighted pigs before market.

Boar studs

Boar studs are composed of relatively small numbers of high-value boars (up to 500 animals per site) housed in a separate enterprise away from any other pigs. These sites have good biosecurity, quality assurance, and tight control over all animals and items that enter and leave the site.

Multisite piggeries

Larger piggeries are typically structured as multisite operations, where one or more breeder farms provide weaners to nursery and weaner sites at 3–4 weeks of age, and then to grower and finisher sites.

Such multisite operations involve continual pig movements. They generally use their own transport or engage a single transport company that uses vehicles exclusive to that operation.

A high standard of health monitoring and biosecurity should operate between and within sites.

Multiple grow-out sites may be owned within the one group or by individual contract growers. Property-to-property (P2P) movements occur regularly to maintain pig flow.

2.1.7 Types of housing systems

Piggery housing systems include:

- conventional indoor housing
- deep-litter housing
- outdoor or free-range facilities.

The following information highlights the features of each type of housing most relevant to the control of EADs. More detailed descriptions of housing types are in Appendix 2.

Conventional indoor housing

Conventional indoor housing is a traditional intensive production system in which all animals are confined indoors within a structure designed to modify the environment for all or part of the production cycle.

The shed flooring is usually partly or fully slatted, or includes open-channel dunging areas. For sheds with slatted flooring, spilt feed and water, urine and faeces fall through the slats into underfloor channels or pits. These are regularly flushed to remove effluent from the sheds.

Although the pigs are housed in pens of varying sizes, there is little opportunity to effectively segregate sick pigs from healthy ones, and much cross-over occurs between different classes or groups of pigs. Usually, one or two pens in a building are set aside as a hospital pen or a recovery pen.

Deep-litter housing

Deep-litter housing in sheds (ecosheds) is widely used to accommodate compatible groups of pigs, such as weaners, growers, finishers and gestating sows. These sheds are frequently open-ended buildings with a poly-tarp-hoop roof and gates to prevent the pigs moving out of either end. They are established on a specially prepared earth floor or a reinforced concrete slab.

Bedding may be fibrous (straw) or particulate (rice hulls or sawdust), or made of similar loose material that absorbs manure, eliminating the need to use water for cleaning.

Weaners, growers and finishers generally move through these sheds in batches (all-in-all-out), with spent bedding cleaned out only after each batch. Spent bedding requires management.

The batch nature of many of these systems reduces the likelihood that an EAD will spread between structures. Isolation and control of a disease within a deep-litter housing system may be possible without affecting other sheds. The bedding used is an unlikely source of infection with an EAD agent.

Outdoor or free-range facilities

Environmental factors, combined with high summer temperatures and seasonal infertility, generally restrict populations of outdoor pigs in Australia to coastal areas in Western Australia and New South Wales, and areas in southern Victoria.

Herds are kept in small paddocks (rotational) or enclosures (feedlot). In a rotational outdoor piggery, pigs are kept in small paddocks, with huts or other basic housing. Feedlot outdoor piggeries continuously accommodate pigs in permanent outdoor enclosures. These enclosures must be located within a controlled drainage area so that stormwater runoff is kept separate from the stormwater runoff from areas outside the pig enclosures.

Pigs may be managed in static groups (no new additions are made to the group after its formation) or dynamic groups (animals are continually added and removed from the group). Where pigs are continually added to groups, the risk of disease transmission is greatly increased. Most outdoor piggeries have multi-aged herds, so the principles of separation and within-herd hygiene cannot be practised.

The design of many free-range enterprises allows access to pigs by wild birds, feral animals, vermin and aerosols. Generally, free-range farms are at greater risk of security breaches by feral pigs and can pose environmental risks if not carefully managed.

2.1.8 Types of piggery management

Piggeries are managed in one of four ways:

- commercial
- integrated
- contract growers and breeders
- smallholder and noncommercial.

Many pigmeat businesses have formed cooperatives and alliances with others in the supply chain. Integrated producers, independent processors and small domestic processors ultimately produce product for export, supermarkets, butchers and food service outlets, such as restaurants.

Larger commercial operations, which house large numbers of pigs, potentially present the greatest challenge to a successful EAD response.

In contrast, the smaller piggeries present the greatest risk of an EAD outbreak, because they may purchase pigs from questionable sources, have less knowledge of EADs, pay less attention to biosecurity and be less aware of the importance of early notification of clinical signs.

The following information highlights the features of each management system most relevant to the control of EADs. In addition, batch-production systems are described.

More detailed descriptions of the operations of each type of management system are in Appendix 2.

Commercial piggeries

Commercial piggeries are sophisticated and complex businesses managed by individuals with extensive industry and business experience.

Managers and employees are generally well trained for their tasks. Most receive specific training in disease control and EADs, and are very capable of assisting in the management of a serious disease event.

Integrated piggeries

The largest pig producers in Australia operate as vertically integrated supply-chain consortiums, combining dedicated breeder farms, contract growers, feedmills, and integrated slaughtering and processing facilities. These businesses are likely to have an abattoir as a key component for slaughter of pigs, whether for salvage or for rendering. They are dependent on regular movements of pigs to maintain pig flow and pig welfare.

Integrated piggeries generally operate under high biosecurity. Managers and employees are usually well trained, with most having specific training in disease control and EADs.

Piggeries run by contract growers and breeders

Contractors do not own the pigs they farm but meet a client's requirements for production of pigmeat suitable to their market or for the supply of breeding stock according to specification.

Piggeries run by contract growers and breeders operate under strict protocols and high biosecurity. Unless introducing pigs from multiple sources, they are at a low risk of introducing an EAD.

There are only a small number of breeder companies; therefore, semen distribution, which may be a factor in disease transmission, is well defined.

Managers and employees are well trained, and most have specific training in disease control and EADs.

Smallholder and noncommercial growers

Smallholder producers are generally considered to be those with fewer than 50 sows. They include owners who may keep only one pig as a pet and those with a few for personal consumption. Pigs are kept in a range of housing systems but are commonly outdoors. The growers may have no approvals to operate.

Many of this group are noncommercial in that they do not farm for profit and may have little interest in the business or technical aspects of pig farming. Many are transient owners and, as a group, may be unknown to authorities. They are difficult to contact and communicate with. They are often located in peri-urban areas where they are unlikely to have direct contact with commercial piggeries.

Knowledge of pig diseases, prohibited pig feeding bans, and implementation of biosecurity measures may be minimal, and some may have no contact with a veterinarian.

A large proportion of these growers will buy and sell pigs through markets using substandard identification and will have minimal records, making tracing difficult.

Biosecurity issues relating to smallholder growers are currently being addressed by government- and industry-funded education programs.

Batch-production systems (all-in-all-out)

Many piggeries manage their pigs in batches as a key component of health management. Batches of pigs of the same age or class are housed together. They may be weaners, growers or finishers of the same age, or they may be sows due to farrow during the same week.

The process requires all pigs to be removed from a shed or site before the next group of pigs is moved in, with the facilities being thoroughly cleaned between each batch. This results in an 'all-in-all-out' process.

2.1.9 Waste

Effluent

Disposal of effluent is a major consideration in the siting, structure and management of a piggery.

All piggery waste needs to be considered in terms of the possible transfer of pathogens that can cause human or pig disease. The *National environmental guidelines for indoor piggeries* (APL 2018) describe good agricultural practices that will protect human health and prevent the transfer of pig pathogens.

Flushing systems are used in many intensive piggeries to keep the piggery clean. The process of flushing away the 2.5–3.0 kg of manure produced by each standard pig per day results in large volumes of effluent and sludge. Typically, this is initially stored in large holding ponds where anaerobic decomposition occurs. Pipes or lined, open channels may be used to convey the effluent from the sheds to the pond.

Although disposal can be achieved by evaporation in drier areas, effluent is commonly applied to pastures and crops because of its high nutrient value. When it is applied to pastures and crops, an accurate estimate of its composition is required to determine the appropriate rate of application. It may be diluted with water when used for irrigating crops. However, soils do not have an unlimited capacity for effluent reuse, and the sites need to have soils suitable for irrigated crop production and rapid nutrient removal.

During extended periods of wet weather, effluent cannot be applied to land, and the pond system must have sufficient capacity to contain both the inflow of waste and the volume added from rainfall.

Manure, sludge and deep litter

In many piggeries, composted manure can be spread onto land on the same property, which minimises the cost of disposal.

Manure management is an important task on many piggeries, especially where pigs are housed outdoors or in shelters. Pig manure, which includes faeces and concentrated urine, has a high nitrogen content. It will often be composted with straw or other organic bedding material, as on its own it is too strong to be used directly as a fertiliser.

About 200 kg of wet litter is produced per pig during the growing and finishing phase of production. The wet litter is sometimes composted, with the dry compost product then being spread on soil

(before crops are sown) at a rate of 5–20 tonnes/hectare, to improve the availability of nitrogen to the crop. It may also be sold to increase the profitability of the piggery.

2.1.10 Carcass management

Piggeries typically have annual mortality rates of 10–15%, 4–6% and 6–10% among suckers, the growing herd (weaners, growers, finishers) and sows, respectively.[14] Carcasses are removed from the pens following daily inspection. The larger carcasses are generally lifted using a loader or carry-all rather than being dragged away – this latter option could result in the discharge of blood and other body fluids, and potentially create work health and safety issues, or disease transmission issues. A single postmortem site is used, generally some distance from the piggery to reduce visual pollution and to reflect good biosecurity practice. The area may be secured by fencing to reduce entry of wildlife or feral pigs.

On farm, dead pigs are usually buried, burned or composted. At processing plants, they are usually rendered. However, pick-ups of dead stock by contract waste disposal companies are common in Victoria. Biosecurity measures must be implemented to prevent spread of disease by pick-up staff, equipment and vehicles.

2.2 Industry organisations

Australian Pork Limited

APL, a not-for-profit company, manages marketing, export development, research, innovation and strategic policy development for the Australian pork industry. APL is a rural industry service body that aims to secure a profitable, sustainable future for the pork industry.

Further information can be found on the APL website.[15]

Other farming and pig organisations

Contact details for other Australian organisations for farming and pig production are listed below:

- Australian Pig Veterinarians – avavic@ava.com.au; 1300 137 309
- NSW Farmers Pig Group – 1300 794 000
- Pork Queensland Inc – qfarmers@qff.org.au
- Pork SA – admin@porksa.com.au
- Tasmanian Farmers and Graziers Association – reception@tfga.com.au; 03 6332 1800
- Victorian Farmers Federation Pig Group – members@vff.org.au; 1300 882 833
- West Australian Pork Producers Association – admin@wappa.com.au; 08 9208 0330
- Elders – elders.communications@elders.com.au; 08 8425 4000
- Nutrien Ag Solutions – asknutrien@nutrien.com.au; 1800 888 642
- Stock Feed Manufacturers' Council of Australia – drowland@sfmca.com.au
- Australian Livestock and Rural Transporters Association – project@alrta.org.au; 02 6247 5434
- Livestock, Bulk and Rural Carriers Association NSW – members@lbrca.org.au; 02 6295 6651

[14] Mortality rates mentioned are for intensive systems. Those for outdoor units can vary due to environmental factors, which should be considered.
[15] https://australianpork.com.au

- Livestock and Rural Transporters Association of Queensland – admin@lrtaq.com.au; 07 3726 5039
- Livestock and Rural Transporters Association of South Australia – admin@lrtasa.com.au
- Livestock Transporters Association of Tasmania – ltat@bigpond.com
- Livestock and Rural Transporters Association of Victoria – office@lrtav.com.au
- Livestock and Rural Transport Association of Western Australia – admin@lrtawa.org.au; 08 9208 0320.

2.3 Industry regulations, standards and programs

Food safety

In addition to regulatory requirements, in 2020, 88% of Australian pork was produced under the Australian Pork Industry Quality Assurance Program (APIQ✓®), which requires pig producers to be audited against comprehensive food safety standards in their on-farm practices.

The industry has a comprehensive livestock traceability system in place to enable a rapid response to a food safety emergency. It also participates in the National Residue Survey, which monitors chemical residue levels in pork.

Australian Pork Industry Quality Assurance Program

APIQ✓® enables producers to demonstrate that their on-farm practices reflect good farming practice. It includes modules addressing food safety, traceability, biosecurity, animal welfare, management, transport and environmental standards.

APL, as the national representative body for pig producers, is the owner and managing agent, and has stewardship of the APIQ✓® program on behalf of the industry.

APIQ✓® is based on managing farm risks by following good agricultural practices. It uses the principles of hazard analysis and critical control points. The APIQ✓® requirements are scientifically based, and complement a practical piggery recording and production management system. APIQ✓® includes voluntary certification and verification of producers against Coles customer standards and gestation-stall-free standards.

The APIQ✓® standards aim to be consistent with government regulations in food safety, biosecurity and animal welfare. They refer to existing standards, including:

- *Model code of practice for the welfare of animals: pigs*, 3rd edition (2007)
- *Australian animal welfare standards and guidelines: land transport of livestock* (2009)
- *National farm biosecurity manual for pork production* (2019).

As of 2020, approximately 88% of Australia's sow herd (30% of producers) were accredited with APIQ✓®. APIQ✓® certification is required to process pigs through an export-accredited abattoir but is not required for domestic processing.

The EAD response for the remaining 70% of producers, who are typically smallholders, will be more complex because understanding of EAD response management and the impact on piggery operations of owners, managers and domestic processors might be less sophisticated.

Food safety regulation

Food Standards Australia New Zealand (FSANZ) develops food standards for the food industry in Australia and New Zealand. It develops the Australia New Zealand Food Standards Code, which is regulated in each state. FSANZ is also responsible for oversight of labelling for both packaged and unpackaged food, including specific mandatory warnings or advisory labels, and country-of-origin labelling.

National Residue Survey

The National Residue Survey (NRS) is a random sampling program run by the Australian Government that monitors chemical residue levels in agricultural commodities to ensure that they are kept at a safe level. Residues tested for in pork include agricultural chemicals (eg pesticides, antibiotics), environmental contaminants (eg heavy metals) and other chemicals of trade concern (eg dioxin). The cost of this monitoring is largely industry funded through levies.

NRS results indicate that compliance of pork products with relevant Australian standards has been at least 99.85% for the past 10 years.

Animal disease regulation

Commonwealth and state and territory legislation has been enacted for controlling EADs. The *Biosecurity Act 2015* (Cwlth) describes how Australia manages biosecurity threats offshore, at the border and onshore. State and territory legislation relating to the management of stock diseases contains wide-ranging provisions that can influence operational procedures, including the availability of produce for markets, during an EAD outbreak. The states and territories have legislative responsibility for responding to EADs in their jurisdictions.

Wide powers are conferred on authorised officers appointed under legislation, including the power to enter premises, impose quarantine, restrict movement of products, order stock musters, test animals, and order the destruction of animals and products that are suspected of being infected or contaminated.

NLIS Pigs

The National Livestock Identification System (NLIS) is a system for the permanent identification and lifetime traceability of livestock. Traceability is very important for disease control, product integrity and market access. The traceability rules or standards that apply to pigs are known as NLIS Pigs, which is integrated into legislation. NLIS Pigs is designed to link pigs to a property of origin using a Property Identification Code (PIC), registered pig identification (ear tags and tattoos), and pig movement documentation. For the pig industry, the system operates through PigPass, and includes the PigPass National Vendor Declaration (PigPass NVD) as the movement document. Refer to the APL website for more information.[16]

In addition to these requirements, most commercial piggeries have sophisticated and accurate inventory control systems that are important for food safety, disease management and production records. Many integrate identification technology into their business, resulting in detailed records that would be of considerable assistance in tracing pigs during an EAD response. Multisite piggeries may use their own recording systems when moving batches of pigs between sites where ownership is not changing. APIQ✓®-certified producers are required to keep accurate records of all pig movements, including property-to-property movements where ownership does not change.

[16] https://australianpork.com.au/industry-guide/pigpass-and-apiq

PigPass

The PigPass system is administered by APL on behalf of the pork industry. A PigPass NVD functions as a movement document for livestock traceability. It provides a declaration that pig production has been carried out in a way that meets agreed industry and government standards relating to food safety, animal disease control and animal welfare. Buyers and processors rely on this information to ensure that food entering the supply chain is safe.

A PigPass NVD should accompany all movements of pigs, including movements to saleyards, abattoirs or a property with a different PIC. Pigs must also be identified (with a pig tattoo or ear tag) in accordance with pig identification requirements in each state before movement commences. It is now the responsibility of the receiver of the pigs to report the movement to the PigPass database using the information on the PigPass NVD.

To obtain a PigPass NVD, pig producers need to be registered on the PigPass database, which requires registrants to provide their PIC, a full property address, and the name and contact details of the person responsible for pig husbandry. Apart from Queensland, pig producers in all states must provide a registered pig brand or tattoo that is linked to their PIC. In Queensland, owners of two or fewer pigs are not required to tattoo brand their pigs, but the pigs must be tagged with an NLIS tag, unless they are 'owner kills' for personal consumption.

Physi-Trace™

Alongside animal identification methodology, the Physi-Trace™ program focuses on development, adoption and implementation of traceability programs to enhance consumer trust in the provenance of Australian pork for domestic and export markets. Physi-Trace™ uses specific trace element tissue profiles to identify the origin of pork products. The strategic plan for Physi-Trace™ is now in place and providing clear direction to industry on the future application and commercialisation of the Physi-Trace™ system for raw pork, ham and bacon.

This software has been designed for investigating unknown pork samples by comparing them with known samples in the Physi-Trace™database. The software provides the analyst with 'best fit' results to the samples in the reference Physi-Trace™ database.

Abattoirs

Postmortem inspection and disposition judgments of all carcases in export-licensed abattoirs are undertaken under Australian Standard 4696:2007 – *Hygienic production and transportation of meat and meat products for human consumption.*

This domestic standard has undergone risk-based review in recent years. As a first step in implementation, alternative carcase inspection procedures and disposition judgments have been given effect in domestic establishments from 1 March 2020 by means of a guideline from the Australian Meat Inspectors Group (AMRG Guideline 2020:1). The alternative procedures and fact sheets are available on the National Meat Industry Training Advisory Council (MINTRAC) website.[17]

Negotiations are underway for AMRG Guideline 2020:1 to be officially recognised as Australian Standard 4696:2021. This will facilitate adoption in export establishments when granted equivalence by export customers.

MINTRAC has also developed a training module for meat inspectors for African swine fever.[18]

[17] www.mintrac.com.au/page.asp?p=175
[18] www.mintrac.com.au/page.asp?p=178

2.4 Animal welfare

Maintaining high welfare standards in the pig industry has become a major issue because international and domestic consumers are becoming increasingly aware of how intensively housed animals are managed. The resulting public and consumer perception of how pigs are housed and treated affects buying decisions. It is therefore important that producers can demonstrate to consumers their compliance with best practice. Industry has engaged with government to ensure that high standards of animal welfare are maintained, as specified in the *Model code of practice for the welfare of animals: pigs*.[19] This is the required standard under APIQ✓®.

To comply with the requirements in the model code, producers certified under APIQ✓® need to:

- arrange contingency plans for feed and water delivery, and for failure and maintenance of equipment and facilities, to minimise risks to pigs
- provide appropriate facilities to protect pigs against weather extremes and injury
- provide sufficient nutritious and palatable food and fresh water for pigs to maintain a healthy body condition
- train staff and maintain competency to ensure good stock sense and care for sick and injured pigs
- ensure that animal health and husbandry measures and practices are in place that are designed to optimise the health and welfare of the herd and minimise risks to pigs
- ensure traceability
- provide animal welfare in the form of PigCare (the Australian pork industry's program for on-farm welfare assessment of pigs)
- ensure that sick, weak or injured pigs are treated and, if necessary, isolated
- provide on-farm euthanasia for prompt and humane destruction and disposal of sick and injured pigs.

Maintaining high standards of animal welfare can help minimise the risks of EAD outbreaks (Heath, 2012).

2.5 Other industry-specific information

Rare breeds

The Australian Pig Breeders Association was established in the early 1900s to provide registration services, produce a herd book, administer memberships and promote pure-breed pigs. The association covers nine breeds of pigs in Australia. They represent a remnant of a seedstock sector that has been overtaken by advanced selection techniques, drawing on molecular genetics and cross-breeding implemented by a handful of modern breeders. PIC, Myora and CEFN are among the market leaders, but a group of smaller breeders supplies seedstock and artificial breeding services to the industry.

The Rare Breeds Trust of Australia provides a watch list for Australian pig breeds.[20] The main breeds in the commercial sector, which produces most of the pigs, are Landrace, large white and Duroc. Berkshires, large blacks, Tamworths, Hampshires and Wessex saddlebacks are held in relatively small numbers by pig breed enthusiasts, often supplying specialty food stores or restaurants. This group of

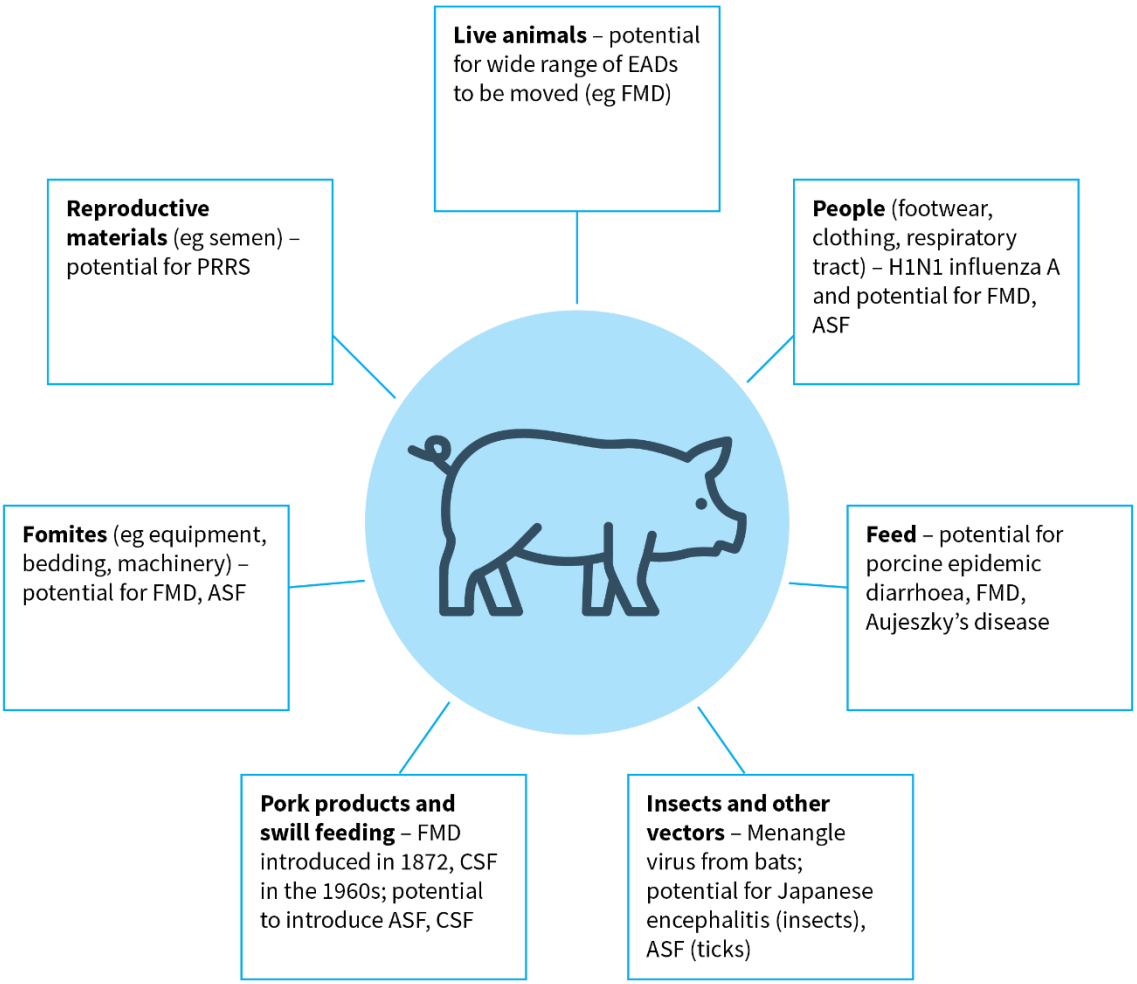
[19] www.publish.csiro.au/book/5698
[20] https://rarebreedstrust.com.au/public/pages/pigs

breeds is considered vulnerable or even threatened. The Poland China, Gloucester old spot, Middle Yorkshire white and Welsh have been lost to the Australian gene pool.

3 Emergency animal diseases and the industry

3.1 The risk of an EAD entering Australia

An emergency animal disease (EAD) can enter Australia by several means. Figure 3.1 describes the risk pathways for introduction of EADs into Australia, and includes examples of previous incursions or potential incursions.



ASF = African swine fever; CSF = classical swine fever; EAD = emergency animal disease; FMD = foot-and-mouth disease; PRRS = porcine reproductive and respiratory syndrome

Figure 3.1 Risk pathways for introduction and spread of emergency animal diseases in Australia

Given the widespread distribution and large population of feral pigs in Australia, and the survival of African swine fever (ASF) virus in meat, feral pigs must be considered a risk for an incursion of ASF into Australia if they are able to access prohibited pig feed, such as from ship or landfill refuse. These animals must also be considered a transmission risk for classical swine fever (CSF), foot-and-mouth disease (FMD) and swine vesicular disease.

CSF was imported, probably on several occasions, during World War II when United States troopships in Sydney unloaded their food waste, which was subsequently fed to pigs. Entry of pig diseases into Australia via aerosol and wind is unlikely, given the distance to Australia's neighbours.

The consequences of an EAD outbreak to the Australian pork industry are potentially catastrophic. Maintenance of strict biosecurity is therefore important for all pork industry enterprises. It is evident from the global spread of ASF that movements of diseases are associated with trade, employment, tourism, unregulated or illegal human activity, and movement of wild or feral animals, regardless of any legal constraints.

3.2 Significant issues for the industry in the event of an EAD incident

3.2.1 Broad issues

In the event of an EAD incursion, the Australian pork industry can expect the following:

- The high efficiency of pork production, dependency of the industry on pig flow and regular movements of pigs and semen, and limited capacity to hold additional pigs on farms will lead to rapid and significant impacts within hours to days of an EAD being declared.
- Access to international markets will cease for a period, depending on the disease and its extent, and the time taken to negotiate the regaining of markets.
- There may be movement restrictions (including a standstill in the case of FMD) of pigs at the state level until the distribution of the disease is defined.
- Semen movement may be stopped, leading to significant impact on output in 9–10 months.
- Interstate movements may be stopped.
- Movements between properties may be stopped.
- Product movements may be stopped.
- Abattoirs may be shut down for immediate cleaning, and this will affect movements and markets.
- Farms may be forced to accommodate on-site several weeks of output of different categories of pigs, with escalating consequences for the welfare of the animals. This may be exacerbated if mixed-species domestic plants choose to discontinue processing pigs, and affected producers are not eligible to process pigs at export-accredited abattoirs.
- Where the welfare of the animals is compromised, some producers will need to euthanase and dispose of pigs if they cannot be moved or slaughtered for human consumption.[21]
- International market closure will lead to increased volumes of pork on the domestic market. Depending on the EAD and the community response, a fall in consumption resulting from a drop in consumer confidence is likely; this will lead to a further increase in supply and a significant fall in the price received, resulting in severe financial hardship for individual producers. In the event of an FMD outbreak, there would also be an oversupply of beef and lamb on the market; pork would be uncompetitive with these products, leading to further effects on price and producer viability.
- Some producers will try to offload their pigs illegally.
- Severely stressed producers, staff and families will be at extreme risk of adverse mental health impacts.

[21] Details on humane euthanasia and disposal methods can be found in the AUSVETPLAN operational manuals *Destruction of animals* and *Disposal*, the *Model code of practice for the welfare of animals: pigs* and APIQ.

- Regional communities that pork production contributes heavily to will be adversely affected.

Adverse effects of movement restrictions

- Within 7–14 days, animal welfare and health problems will emerge for multisite enterprises.
- The numbers of pigs that cannot be processed may result in the need for on-farm euthanasia of normal, healthy pigs.
- Substantial animal welfare challenges are likely.
- Public attention and government resources may be drawn to animal welfare issues, potentially drawing officials away from the stamping-out response.

The adverse effects of movement restrictions may occur at the industry scale and have far greater negative impacts than stamping out a small number of infected premises.

3.2.2 Commercial implications

Commercial implications of an EAD outbreak affecting the pig industry include:

- loss of income for people and companies involved in the pig industry, including producers, abattoirs, processing plants and manufacturers
- loss of income for associated industries, including animal transporters, and feed producers and transporters
- a significant loss of animals, as well as important genetics, in affected areas
- long-term effects on sustainability of producers, processors and allied industries
- flow-on effects on rural communities.

3.2.3 Nature of the incurred losses

Loss of income for producers will occur as a result of:

- loss of sales
- closure of export markets, resulting in loss of export income and oversupply of pork on the domestic market
- slaughter of pigs for welfare reasons when they cannot be moved
- increased operating costs due to increased number of pigs that cannot be moved off-site and an associated increase in feed costs
- loss of consumer confidence in pork products both domestically and internationally, which may lead to long-term reduction in demand and/or change in supplier
- depopulation and decontamination of farms, and down times before restocking is allowed.

Loss of income for abattoirs will occur as a result of loss of supply of pigs for slaughter. However, this may be offset if abattoirs accept pigs that need to be culled for disease control purposes.

Interruptions to semen supply will have long-term effects on genetics, and pig quality and numbers.

Job losses are likely as businesses respond to reduced supply and demand, leading to the inability to maintain normal business operations.

Costs will be associated with on-site burial, and long-term environmental and economic consequences.

3.2.4 Possible longer-term implications

Long-term implications will vary with the type of EAD, its location and spread, and the export and domestic market response.

If the loss of access to Australian pork products in customer countries leads to sourcing of products from competitor countries, in the long term, this may lead to a reduction in demand for Australian pork products and a loss of export income, even if access is re-established.

Under the guidelines of the World Organisation for Animal Health (OIE), there is opportunity for a containment zone[22] to 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.

Recognition of such zones must be negotiated between the Australian Government and individual overseas trading partners, and 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.

[22] The OIE 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 and Water Resources 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.

4 Emergency animal disease preparedness and management

4.1 Australia's animal health services

Australian governments, primary industries and other stakeholders work closely together to prevent, detect, control and manage pest and disease outbreaks, and minimise impacts on the economy, environment and international trade. To do this effectively, governments, industries and stakeholders use consistent and collaborative approaches to determine national animal health priorities. The livestock industries are active partners in policy development, support targeted animal health activities and contribute to emergency responses.

4.2 National arrangements

Governance arrangements for the response to emergency animals diseases (EADs) are outlined in the **AUSVETPLAN *Overview***.

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

Australia's response planning and coordination are enhanced by collaborative national arrangements between governments and industry, and other key stakeholders. These arrangements include:

- the Government and Livestock Industry Cost Sharing Deed in Respect of Emergency Animal Disease Responses (Emergency Animal Disease Response Agreement – EADRA)
- the Australian Veterinary Emergency Plan (AUSVETPLAN)
- training for EAD response personnel.

Coordination of the response to EAD incidents is further enhanced by the use of established consultative committees and management groups.

4.2.1 Emergency Animal Disease Response Agreement

The EADRA[23] is a legally binding agreement between the Australian Government, state and territory governments, livestock industries and Animal Health Australia. It supports a rapid and efficient response to an EAD outbreak.

The agreement establishes basic operating principles and guidelines, and defines roles and responsibilities of the parties that are involved. It provides for formal consultation and dispute resolution between government and industry on resource allocation, funding, training, risk management and ongoing biosecurity arrangements.

The signatories of the EADRA are committed to:

- minimising the risk of EAD incidents by developing and implementing biosecurity plans for their jurisdictions or industries

[23] The full title of the agreement is the Government and Livestock Industry Cost Sharing Deed in Respect of Emergency Animal Disease Responses. For more information, see www.animalhealthaustralia.com.au/eadra/.

- maintaining capacity to respond to an EAD by having adequate numbers of trained personnel available to fill the response functions specified in AUSVETPLAN
- participating in decision making relating to EAD responses, through representation on the Consultative Committee on Emergency Animal Diseases (CCEAD) and the National EAD Management Group (NMG) established for the incident
- sharing the eligible response costs of EAD incursions using pre-agreed cost-sharing formulas.

Four categories of diseases are used to determine the liability for costs. These categories have been developed according to the benefits of controlling the disease, as assessed by the likely impact of the specific EAD on human health, socioeconomics, the environment and livestock production.

Table 4.1 describes the four disease categories and their respective cost-sharing arrangements.

Table 4.1 Disease categories and cost-sharing arrangements

Category	Cost-sharing arrangement
1	100% government
2	80% government 20% industry
3	50% government 50% industry
4	20% government 80% industry

The EADRA also contains many other important instructions that provide the basis for a coordinated national EAD response. In particular, it refers to using existing plans, such as AUSVETPLAN; sets standards for accounting, auditing and training personnel; and provides the incentive for developing and maintaining government and industry biosecurity measures.

4.2.2 AUSVETPLAN

This enterprise manual is part of AUSVETPLAN – Australia's Veterinary Emergency Plan.

AUSVETPLAN is Australia's nationally agreed approach to responding to EADs of national significance. It comprises resources that support efficient, effective and coherent responses to these diseases. It has been developed and agreed on by governments and relevant industries in non-outbreak times to ensure that a fast, efficient and effective EAD response can be implemented consistently across Australia with minimal delay.

AUSVETPLAN provides the contingency planning framework for Australia's response to EADs, and is complemented by a range of other plans and resources, including:

- national and state/territory standard operating procedures for the implementation of certain response measures
- plans involving other areas of state and territory emergency management arrangements (eg police, local government)
- diagnostic resources
- training materials.

4.2.3 Training for emergency animal disease response personnel

It is a requirement of the EADRA that, where possible, signatories (governments and industries) use appropriately trained staff to undertake the response functions outlined in AUSVETPLAN for an EAD response.

Governments provide training in response functions for their personnel.

Animal Health Australia's Training Services project provides training for government personnel and representatives of the Australian livestock industries to help prepare them to participate in the CCEAD and the NMG. The program also provides training for livestock industry representatives to prepare them to undertake the Liaison – Livestock Industry function in either a state coordination centre (SCC) or a local control centre (LCC).

The responsibilities of the SCC and LCC Liaison – Livestock Industry functions are documented in the **AUSVETPLAN management manual *Control centres management*, Part 2**.[24]

4.3 Controlling an emergency animal disease incident

4.3.1 Governance

Control of an EAD outbreak is a complex operation, requiring rapid mobilisation of resources and coordination of a diverse team of people. An EAD response may require input from all tiers of government and from a range of portfolios, as it may need to address not only animal health issues, but also financial, social, economic, human, trade and recovery issues.

EAD responses are planned and implemented at three levels: national, state or territory, and local.

The Australian Government (through the Department of Agriculture, Water and the Environment) provides international liaison during an EAD response; this includes market access negotiations, international reporting (eg to the World Organisation for Animal Health (OIE)), and coordination of access to overseas assistance through existing agreements. The Australian Government also provides national coordination for the response; more information is provided in the **AUSVETPLAN management manual *Control centres management*, Part 1**.

The CCEAD is the key technical coordinating body, providing the link between the Australian Government, states and territories, industry, Animal Health Australia and the NMG during an EAD response.

The NMG manages national policy and resourcing of the response. It determines whether a disease is eradicable and whether the direct costs of a response should be shared between Australia's governments and the relevant livestock industry(ies) under the EADRA.

Both the CCEAD and the NMG base their recommendations and decisions on current information provided by the affected state or territory, and on guidance provided in AUSVETPLAN.

In an EAD outbreak, relevant state or territory animal health officials manage all aspects of its control and eradication according to a nationally agreed plan (Emergency Animal Disease Response Plan (EADRP)).

[24] www.animalhealthaustralia.com.au/ausvetplan/

The chief veterinary officer (CVO) of the state or territory in which an EAD outbreak occurs implements disease control measures as agreed in the EADRP and in accordance with relevant legislation. State or territory animal health (or, in many cases, biosecurity) legislation provides broad powers to enable an effective response to EADs, including the ability to enter premises, examine records, order livestock musters, control livestock movements, request that animals or products be submitted for testing, and isolate and destroy diseased or suspected diseased livestock.

An SCC may be established to coordinate response activities across the state or territory, in accordance with the strategic direction provided by the CVO, the CCEAD and the NMG. The SCC maintains overall control of the incident under the CVO and is able to give specific directions to the LCCs to ensure that the CVO's intentions are met.

Disease control activities are managed from an LCC, usually established in the vicinity of the outbreak. The LCC is responsible for all operational activities within a defined area, assigned by the CVO, including investigations of reports of disease outbreaks; consultation with livestock producers and processors; specimen collection; property quarantine; valuation of livestock and property; livestock slaughter; livestock product tracing, treatment and disposal; and property decontamination.

Information on the structure, functions and responsibilities of the SCCs and LCCs is contained in the ***Control centres management*** **manual, Part 1**. Detailed descriptions of functions and associated activities in an EAD response are contained in the ***Control centres management*** **manual, Part 2**.

The CVO makes ongoing decisions on follow-up disease control measures in consultation with the CCEAD and, where applicable, the NMG, based on epidemiological information about the outbreak.

4.3.2 Response measures

The response to an EAD will be determined by the nature of the outbreak, including:

- how early the outbreak is detected
- the extent of the outbreak
- the location of infected, suspect, trace and dangerous contact premises
- which species of livestock are affected
- the characteristics of the disease agent involved.

The fundamental aim of national EAD control policy is to eradicate an EAD if this is reasonably feasible. Key factors taken into account are those related to the disease and affected population. For example, the principal option used for many EADs is eradication by stamping out where this is applicable to the EAD in question and is considered to be cost-effective. This may involve use of all or some of the following procedures:

- epidemiological assessment (to understand how the disease is behaving in that particular outbreak)
- quarantine of premises and/or movement controls on potentially infected or contaminated live animals, animal products, people, equipment, vehicles and other things – this will include a national livestock standstill if foot-and-mouth disease (FMD) is strongly suspected or confirmed; see the **FMD response strategy** for more information
- tracing of potentially infected animals, and potentially contaminated products and things (eg equipment, vehicles)
- surveillance of susceptible animals
- biosecurity measures for people and equipment
- management of animal welfare

- valuation and compensation for livestock and property (including milk and milk products) destroyed as part of the EAD response
- destruction and disposal of infected and exposed susceptible animals, animal products and contaminated materials
- decontamination of infected premises
- restriction of the activities of certain enterprises
- an industry and public information program.

Other measures that may be used where necessary include:

- vaccination
- vector or wild animal control
- treatment of affected animals
- treatment of affected products
- use of sentinel animals
- zoning and compartmentalisation.

In some circumstances, a modified stamping-out approach may be used – for example, by allowing the slaughter of animals at an accredited abattoir to produce a marketable product.

Sometimes, eradication is not considered feasible because the outbreak is already widespread when diagnosed or is considered likely to spread further despite the application of stamping out. In these cases, other control measures may be selected, such as vaccination, with a view to possible containment and eventual eradication; or a state or territory and/or industry-based control program to manage a disease that is likely to become endemic in the population. Where the NMG has reason to believe that eradication is not possible and the disease can only be contained, or in any situation where the cost of an EADRP will exceed an agreed limit on funding, the NMG may decide to stop cost sharing and transition to management.

4.3.3 Overview of declared areas and premises classifications

Declared areas

A declared area is 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 (RA) and control area (CA).

Declared areas are declared under jurisdictional legislation. RAs are subject to strict disease control measures. CAs are disease-free buffers between an RA and the parts of Australia that are free from disease (the outside area – OA).

All declared areas need to be clearly identified and easily understood, so that all affected parties can recognise which area they are in, and what regulations and control measures are applicable to them.

Declared areas are declared by a CVO or their delegate, or a ministerial declaration, according to the appropriate legislation of the states and territories involved.

There are also other areas that are not legally declared, but are used for specific reasons:

- transmission areas (TAs), which are used for vector-borne diseases for epidemiological purposes, recognising that vectors are not confined by property boundaries
- the OA, which is used to describe the rest of Australia outside the declared areas.

Figure 4.1 provides a schematic illustration of declared areas and standard movement controls.

Area definitions for non-vector-borne diseases

Restricted area (RA)

An RA is a relatively small legally declared area around infected premises (IPs) and dangerous contact premises (DCPs) that is subject to disease controls, including intense surveillance and movement controls.

An RA will be a relatively small declared area[25] (compared with a CA – see below) drawn with at least 'x' km radius[26] around all IPs and DCPs, and including as many suspect premises (SPs), trace premises (TPs) and dangerous contact processing facilities (DCPFs) as practicable. Based on risk assessment, the RA is subject to intense surveillance and movement controls, and other relevant disease 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.

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 OA (see below). Specific movement controls, surveillance strategies, and other relevant disease controls 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 'y' km,[27] encompassing the RA(s). 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 CA. The boundary will be adjusted as confidence about the extent and distribution of the incident increases.

[25] As defined under relevant jurisdictional legislation.
[26] For specific details, refer to the relevant AUSVETPLAN response strategy, www.animalhealthaustralia.com.au/ausvetplan.
[27] For specific details, refer to the relevant AUSVETPLAN response strategy, www.animalhealthaustralia.com.au/auzvetplan.

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 more likely to be permitted to move under permit within and from the area than those originating from the RA.

Outside area (OA)

The OA is the area of Australia outside the declared (control and restricted) areas.

The OA is **not** a declared area but is used to describe the rest of Australia outside the declared areas. The OA will be subject to surveillance. Because it is highly desirable to maintain the OA as 'disease-free', the movement of animals and commodities from the RA and CA into the OA will be restricted.

The OA will also be of interest for zoning[28] and compartmentalisation[29] for purposes of trade access, as well as for disease control (see below).

Area definitions for vector-borne diseases

Transmission area (TA)

A TA is an area, not legally declared, that is used for vector-borne[30] diseases for epidemiological purposes, recognising that vectors are not confined by property boundaries. It includes IPs and, where possible, SPs, TPs, DCPs and DCPFs. A TA is subject to an increased level of surveillance, and has movement controls appropriate to its associated RA.

Vector-borne diseases differ from non-vector-borne infectious diseases in that vectors cannot be contained by boundary fences. The TA is thus less concerned with property boundaries or definitions and more with including all infected vectors in the area surrounding known areas of transmission. It will be drawn around known sources of transmission, as evidenced by disease, seroconversion, trapping of infected vectors and any other confirmation of active disease transmission. There may be insufficient information at the start of a response to identify a TA, and an RA may be put in place before a TA can be determined.

A TA is not a legally declared area but will include all IPs and, where possible, all SPs, TPs, DCPs and DCPFs. In the presence of competent vectors, a TA of 'x' km[31] radius should be drawn. The TA 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. This distance will depend on the information gained about vector numbers and competence, environmental factors (eg prevailing winds, rainfall, temperature, humidity), and the number and distribution of infected and/or susceptible animals. In the absence of competent vectors, the TA may be reduced in size.

Restricted area (RA)

An RA will be a larger legally declared area around the TA. The boundary of the RA does not have to be circular or parallel to that of the TA but should be at least 'y' km from the boundary of the TA; this distance may be influenced by World Organisation for Animal Health (OIE) standards or an official control program. The RA can include areas of known competent vector distribution. In general, surveillance may be less intense than in the TA, but movement controls will be the same.

[28] The process of defining, implementing and maintaining disease-free and infected areas, in accordance with OIE standards. Zoning is based on geopolitical and/or physical boundaries and surveillance, in order to facilitate disease control and/or trade.
[29] The process of defining, implementing and maintaining one or more disease-free establishments, under a common biosecurity management system, in accordance with OIE standards. Compartmentalisation is based on applied biosecurity measures and surveillance, in order to facilitate disease control and/or trade.
[30] In most cases, a TA is focused on insect (arthropod) vectors.
[31] For specific details, refer to the relevant AUSVETPLAN response strategy, www.animalhealthaustralia.com.au/ausvetplan.

The boundary of the RA will be adjusted as confidence about the extent of the incident increases. It will take into account the relevant OIE *Terrestrial animal health code* chapter on the disease and, if appropriate, OIE standards on zoning and compartmentalisation (Chapter 4.3[32]).

Other types of areas

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

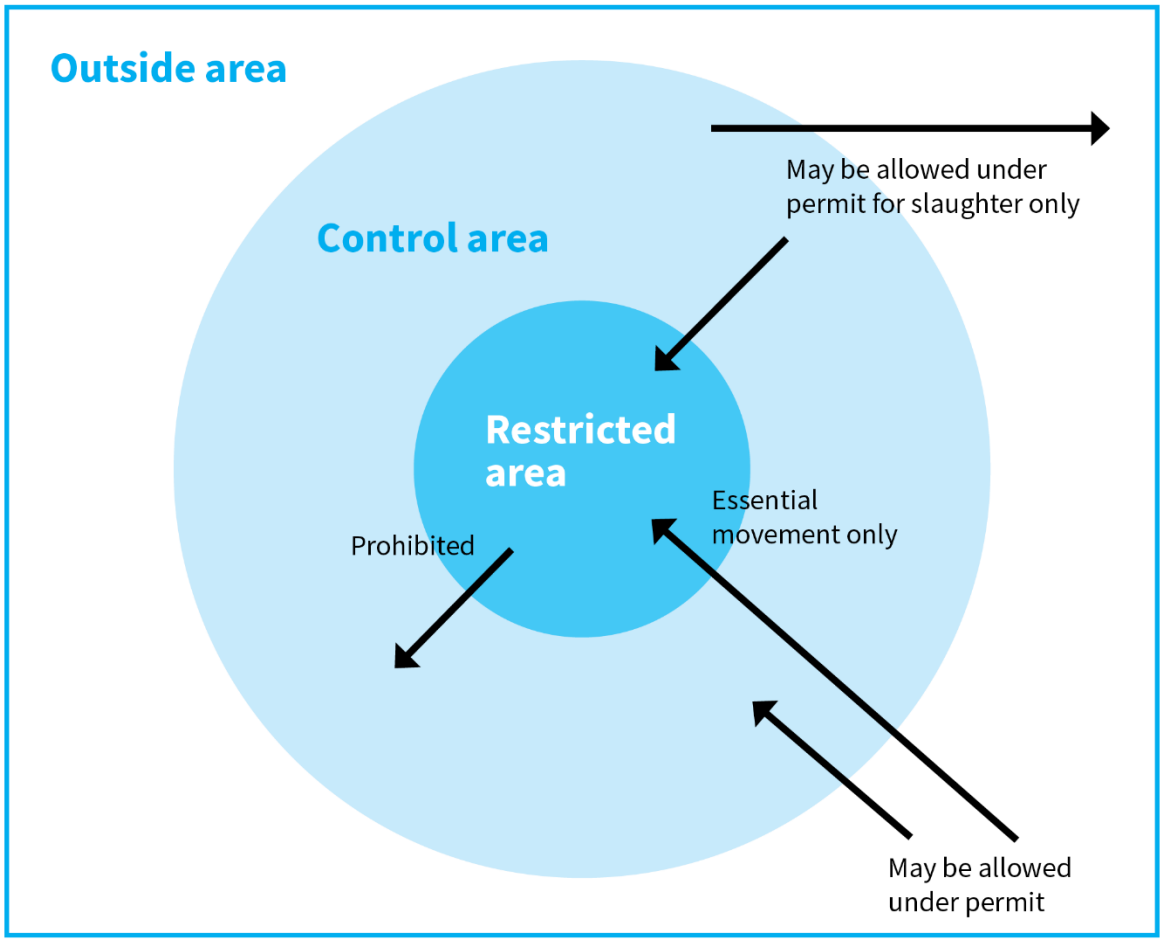


Figure 4.1 Schematic illustration of declared areas indicating standard movement controls

Premises classifications

All premises within declared areas are subject to classification for disease control management and monitoring purposes.

A particular property (or premises) must fit clearly into only one premises classification at a given time. The classifications and their abbreviations are (in alphabetical order):

- approved disposal site (ADS)
- approved processing facility (APF)
- at-risk premises (ARP)
- dangerous contact premises (DCP)

[32] www.oie.int/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access

- dangerous contact processing facility (DCPF)
- infected premises (IP)
- premises of relevance (POR)
- resolved premises (RP)
- suspect premises (SP)
- trace premises (TP)
- unknown status premises (UP)
- zero susceptible species premises (ZP).

In addition to these premises definitions, the following 'qualifiers' may be used to describe the outcome of a recent investigation, epidemiological risk assessment or other activity on premises where their status has not changed:

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

For example, an ARP that has been determined by the relevant jurisdictional authority as being 'assessed negative' should be recorded as 'ARP-AN', and an IP that has completed a vaccination program should be recorded as 'IP-VN'.[33]

Not all classifications may be needed in a particular EAD response.

Classification of premises provides a framework for authorities to exercise legal powers over such premises, facilitates product tracking, and serves as a communication tool for reporting nationally and internationally on progress in the response.

4.3.4 Use of declared areas and premises classifications in an EAD incident

When an EAD incident 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[34] (ie the index case[35]), the relevant CVO or their delegate will determine the premises classification and may declare the premises an IP.

After the identification of the first IP, an RA and a CA may be declared.[36] A 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, ARP, POR, UP and 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 SPs and TPs. These will 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, DCP or DCPF. Both an SP and a TP

[33] Some jurisdictions might have a date associated with the 'assessed negative' qualifier.
[34] Note that case definitions are under development for some manuals and also that some diseases could be present without showing clinical signs.
[35] The first case to come to the attention of investigators.
[36] This is invariably the case with highly contagious diseases (eg FMD, equine/avian/swine influenza, classical swine fever) but may not apply to less contagious diseases (eg Hendra virus, anthrax, Australian bat lyssavirus).

might also be assessed as negative and qualified as SP-AN and 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 Industry preparedness

5.1 National-level industry preparedness and response planning

For pig-related emergency animal diseases (EADs), Australian Pork Limited (APL) participates in a number of national EAD preparedness and response planning activities on behalf of the national pork industry. APL also contributes to reviews and updates of the Emergency Animal Disease Response Agreement (EADRA) and AUSVETPLAN. APL ensures that personnel are trained to undertake roles as pork industry representatives on the Consultative Committee on Emergency Animal Diseases (CCEAD) or the National Management Group, or to fill the Liaison – Livestock Industry function in state coordination centres or local control centres.

The EADRA ensures that funds to combat an EAD are made available and the costs are shared among the beneficiaries of the response. It also commits parties to take all reasonable steps to minimise the risk of an EAD occurrence in the first place (eg through development and implementation of biosecurity plans and EAD response preparedness).

PorkSAFE

PorkSAFE is the Australian pork industry's crisis management plan for an actual or potential incident or perceived critical issue, at either the farm or product level, that could adversely affect the reputation, people, operations or assets of the industry.

The objectives of PorkSAFE include:

- preventing an adverse impact to the pork consumer, pork industry or APL through continuous monitoring and early intervention; or minimising the consequences if an incident occurs
- providing arrangements for APL to respond to an event of any size, complexity or circumstance
- providing the structure for APL to effectively integrate with other response capabilities (biosecurity, industry, health, food safety), minimising consequences to the pork industry.

PorkSAFE has been developed using the principles in the Australasian Inter-Service Incident Management System (AIIMS)[37] and is to be used in conjunction with other plans and incident management and recovery arrangements. The AIIMS arrangements are adopted to ensure that APL can seamlessly integrate with multi-agency responses. The terminology and structure are consistent with the other agencies, as well as the Biosecurity Incident Management System.

In the event of an EAD outbreak, PorkSAFE directs industry involvement, and ensures effective and timely communication through the media and directly with producers, APL staff and other key stakeholders.

[37] www.afac.com.au/initiative/aiims

5.2 Enterprise-level industry preparedness and response planning

EAD response planning is a critical part of the pork industry's preparedness for an outbreak, or suspicion of an outbreak, of an EAD in Australia. Response planning will assist producers and others in the pork industry to:

- reduce the risk of introducing disease to their enterprise
- if the premises is already infected or contaminated, reduce the risk of spreading the disease within the premises or to other premises
- work with government biosecurity officers to manage an EAD outbreak with the highest degree of mutual understanding and efficiency
- minimise the time out of domestic and export markets.

In addition to disease control principles, other factors that need to be taken into account in developing appropriate response plans include:

- protection of valuable breeding stock
- animal welfare
- use and/or disposal of pork
- pork collection operations
- environmental impacts
- business continuity.

Enhancing routine on-farm biosecurity, as part of contingency planning, provides a solid basis for protecting pork enterprises and the industry in the event of an EAD outbreak. Guidelines on how to enhance on-farm biosecurity as best management practice are available from APL.[38] The Farm Biosecurity website also provides guidance on how to improve on-farm biosecurity and how to develop an EAD action (or response) plan.[39,40]

5.3 Biosecurity measures and the industry

As outlined in Section 4.2, the type of biosecurity measures applied during an EAD response will depend on the specific disease, and the disease status and risks associated with the premises. Guidance is available in the disease-specific documents in AUSVETPLAN.[41] Information specific to each outbreak will be available from animal health authorities (eg from the local control centre) and through the 'National pest and disease outbreaks' website.[42]

In the context of an EAD response, aspects to consider include:

- general biosecurity
- surveillance
- maintaining pig health
- monitoring pig health at slaughter
- movements of pigs, people and transports

[38] https://australianpork.com.au/industry-focus/biosecurity
[39] www.farmbiosecurity.com.au/wp-content/uploads/2013/03/Emergency-Animal-Disease-Action-Plan.pdf
[40] www.farmbiosecurity.com.au/wp-content/uploads/2014/07/Preparing-your-business-to-survive-an-emergency-animal-disease-outbreak.pdf
[41] www.animalhealthaustralia.com.au/ausvetplan
[42] www.outbreak.gov.au

- enhanced record keeping
- managing semen from semen collection centres
- piggery location
- batch-production (often weekly) systems
- site structure
- feed supplies
- provision of feed to pigs
- water supplies
- effluent
- manure, sludge and deep litter
- disposal of carcasses
- temperature and ventilation
- staff training
- wildlife, vermin and feral animal control
- vehicle disinfection.

5.3.1 General biosecurity

Most sectors of the pig industry are aware of the risks of disease transmission and practise a high level of biosecurity.

Biosecurity measures include:

- daily herd inspections
- daily records of pigs that require treatment or that die
- regular veterinary visits that include targeted testing of pigs that die, together with laboratory submissions
- preventing the spread of disease by
    - providing farm boots and overalls,
    - ensuring clear demarcation between clean and dirty areas
    - having a 'no vehicles on site' policy
    - fencing pig production areas to a level that precludes entry of other pigs, sheep or cattle.

Buildings in piggeries may be bird-proof and rodent-proof. However, this is not always the case, and many piggeries with a minimal approach to biosecurity will not have suitable screening on sheds. Outdoor and free-range farms may have little protection from contact with wildlife, foxes, feral pigs or cats.

Further details on biosecurity requirements are provided on the Farm Biosecurity website.[43]

APIQ✓®-certified piggeries

Through the Australian Pork Industry Quality Assurance Program (APIQ✓®), the pig industry is aware of the risks of disease transmission and practises a high level of biosecurity. A formal industry biosecurity program is designed to control endemic diseases. Compliance with standards covering breeding and production of pigs from birth to sale is an integral part of APIQ✓®. APIQ✓®-certified

[43] www.farmbiosecurity.com.au/

piggeries are required to document their biosecurity management procedures, including procedures to minimise the likelihood of disease entering, spreading or escaping.

The following standards apply to APIQ✓®-certified piggeries:

- All movements are controlled, and most farms restrict the entry of people, machinery and vehicles, and restrict access to all areas. A single route is used by all incoming and outgoing vehicles, machinery and equipment.
- Visitors entering the piggery complex are assessed for their biosecurity risk and are required to sign a visitors book to assist trace-back and trace-forward in the event of an EAD outbreak.
    - On some farms with high health status, visitors are required to sign an undertaking that they have not visited other farms or other potentially contaminated sites in the previous 24–72 hours. Should they need to have contact with pigs, they are required to change into clean protective clothing and farm boots before entering any shed or adjacent area, or will be supplied with lightweight plastic disposable shoe covers.
    - Regular visitors to the internal parts of the farm include veterinarians, nutritionists, management consultants and senior managers for farming businesses. These people must meet the herd biosecurity rules.
    - Sales representative visits are usually restricted to external areas or offices with an external entrance.
    - Tradespeople (electrical, plumbing) and regulatory officers visit under special arrangements that also involve specific biosecurity measures.
    - Normal practice for transport vehicles is for the driver to load from the ramp to the tray and not to breach the defined 'clean' farm boundary.

Pest control procedures are audited on APIQ✓®-certified piggeries.

Stock and semen are sourced in compliance with biosecurity requirements and Australian law; this minimises the risk of introducing disease-causing agents of significance through stock and semen.

Employees are trained to understand the mechanisms of disease spread, including the potential for introducing and transmitting diseases via pigs, feedstuffs, people, vehicles, machinery and equipment, feral animals and wildlife, and manure and effluent. They are usually required to have no contact with pigs at their homes. They may be required to shower on entry, and change into clean protective clothing and farm boots when entering the farm, or are supplied with lightweight plastic disposable shoe covers.

More information on the APIQ✓® biosecurity standards can be found on the APIQ✓® website.[44]

5.3.2 Design of the enterprise

Biosecurity protocols mean that loading ramps and feed silos should be at, but outside, the perimeter fence, if possible. If this is not possible, signposted 'dirty' areas should be designated at loading ramps and silos. Drivers are required to remain in the designated dirty area and piggery staff in the clean area.

In APIQ✓®-certified piggeries, dirty and clean areas for staff and visitors entering sheds are defined. Staff and visitors entering sheds remove their street clothes in the designated dirty area, then change into protective boots and clothing, and wash their hands and any necessary equipment before moving

[44] www.apiq.com.au/

into the clean area. Staff or visitors are not allowed to enter sheds if they have entered sheds or handled pigs on another piggery that day. If an exception is made, showering before entry is generally required.

Many large piggeries have a dedicated wash area with a concrete apron, where machinery and vehicles are washed.

5.3.3 Location

Piggeries are usually located close to supplies of grain and other feedstuffs. Access to labour, major highways, abattoirs and saleyards is also an important consideration in piggery sustainability and environmental management. Climate can have a significant impact on the environmental performance of a piggery, especially wet conditions, which may result in excessive odour.

As a result of these factors, several areas in Australia have a high concentration of pig properties and consequently increased potential for spread of an EAD. Piggeries are becoming larger, which means that special measures are needed to maintain efficient production while complying with environmental guidelines. These include the trend to reduce the total numbers and production phases on a single site by developing sites for each class of pig. Although the larger commercial producers will aim to isolate and separate components of their enterprise and implement strict biosecurity protocols, this is not always the case with older and smaller farms.

Location is subject to a range of planning controls designed to ensure that community standards are met with respect to a piggery's impact on the environment and amenity. Each state and territory has its own legislation, codes of practice, regulations and guidelines for the development and operation of piggeries, as well as more general legislation governing water use, land clearing and other relevant issues. There are also applicable local government planning and approval regulations.

Approval for a piggery is required from the relevant state or territory environmental protection agency, as well as local government. Requirements vary between states and between councils in each jurisdiction, and do not always consider site-specific or management-specific features, which can influence environmental risks.

The *National environmental guidelines for indoor piggeries* (APL 2018) provide guidance for environmental assessments for new piggeries and options for existing piggeries to achieve positive environmental outcomes. The guidelines incorporate current scientific information and a risk assessment approach to maintaining piggeries, and facilitate a consistent regulatory approach to environmental controls throughout Australia.

5.3.4 Surveillance

EAD surveillance is an extension of the routine day-to-day health program activities on any APIQ✓®-certified farm.

Rapid recognition of new cases will greatly assist disease control by allowing appropriate measures to be implemented on infected premises, limiting the potential for the disease to spread further.

Personnel on premises with susceptible animals should regularly observe the livestock for signs of EADs, in addition to any surveillance undertaken by the government animal health authority. Signs will vary with the disease and may include drops in production or clinical signs (eg salivation, lameness). Guidance on signs to look out for, and how to report, is available:

- in AUSVETPLAN response strategies
- from government animal health agencies (including through their websites)
- during an outbreak, from the 'National pest and disease outbreaks' website.[45]

The effectiveness of surveillance on farm will be enhanced if awareness materials are displayed on-site and training in EAD awareness is routinely provided to staff.

5.3.5 Feed

Feed that has been stored in a secure silo may have avoided contamination with an EAD agent, but the nature of the feed and its composition should be considered on a case-by-case basis. Investigations have shown that some imported feed ingredients or additives have the potential to contain infective viruses (Niederwerder 2021). The other main risk comes from ingredients that are packed in recycled bags that may have been on infected sites.

Supplies

Many piggeries have multiple daily deliveries of feed, which must be continual to provide for the welfare of the pigs. Deliveries to a piggery (whether a single site or multisite) will generally be by vehicles that are only used for deliveries to that piggery. In most piggeries, feed vehicles need to drive close to the individual pig units to deliver feed, but the risks associated with this are low, as there is little or no contact with the piggery itself. Some farms have feed delivery points (auger or blower intakes) located outside the perimeter fence to prevent access of trucks and drivers to livestock areas.

In an EAD response, the cost of feed is normally the responsibility of the owner of the pigs. However, in some situations, the disease control authority may require pigs to be kept for an extended period before eventual destruction. In such cases, responsibility for the cost of feeding and maintaining the pigs may need clarification.

5.3.6 Training of staff

Disease awareness training includes:

- staff training on disease recognition and response
- manuals, handouts and webinars
- disease recognition posters
- definition of clean and dirty areas, and key actions within each.

5.3.7 Movement

The widely distributed nature of multisite piggeries means that there are frequent movements of livestock transports on and off most of these piggeries. Breeding sows are moved, and other pigs are moved from breeder to nursery sites, and then to grower–finisher sites, and ultimately to an abattoir (or potentially to market first if they do not meet specifications).

Weaners and slaughter pigs are the most transported classes of pigs, and movements often occur across state borders. More than 90% of pigs are sold directly for slaughter or moved to a contract grower, and the remainder are sold through saleyards or via some other arrangement.

[45] www.outbreak.gov.au

The multiple movements of pigs associated with piggery management are only likely to be a major biosecurity concern where pigs are sourced from a market or small piggery, or biosecurity is poor.

Larger piggeries assign dedicated trucks to pig movements and manage them according to strict cleaning and biosecurity protocols. If trucks have been cleaned and disinfected appropriately between loads, movements of feed and materials on and off piggeries are unlikely to pose a high risk during an outbreak of an EAD. Smaller piggeries are generally aware of the health risks associated with transport between piggeries but may not have dedicated trucks. However, some will work with other nearby piggeries to achieve a group level of biosecurity that is similar to that of larger enterprises.

All types of movements are documented according to PigPass and the requirements in the enterprise's biosecurity manual. This information forms a basis for tracing during an EAD response and for limiting movements if necessary.

Inward movements include grain supplies and other components of rations or prepared feed from a commercial feedmill. Dedicated trucks may be used in the larger piggeries. In smaller piggeries, a truck may visit several farms on each trip; this requires additional care in cleaning and managing contact with clean parts of other piggeries.

Outward movements include movement of dead pigs to a rendering plant or a burial site, and movement of deep litter from sheds for use as fertiliser.

5.3.8 Animal health

A high standard of daily disease monitoring and follow-up provides confidence of early detection of, and response to, unusual signs of disease. Most piggeries have an alert and trained workforce that is experienced in the daily monitoring of pig health and early reporting of possible disease. They can promptly implement site control and can be incorporated into health monitoring activities during an EAD response. Additional effort may be needed to familiarise personnel with EADs, especially EADs with clinical signs that have not previously been seen in Australia or that may present similarly to diseases that occur in Australia.

Monitoring pig health at slaughter

Carcases and various organs of pigs are commonly examined at abattoirs for the presence and severity of a range of pig diseases that can significantly affect production efficiency. Results defining the health status of growers are reported to producers and their veterinarians, who can then accurately plan disease control strategies.

Slaughter pigs are checked because many of the diseases that affect grower pig performance do not cause any clinical signs, although the lower growth rates of subclinically affected pigs may significantly reduce profitability. Slaughter monitoring allows a regular herd assessment of disease levels, and supplements information from production records and farm postmortem examinations.

For each disease, a report may be provided on the prevalence or proportion of pigs that show lesions. The more significant diseases are generally reported in greater detail to producers, who receive reports with historical tables and graphs for each disease.

This type of monitoring shows the importance placed on disease recognition and control in the pig industry. It also shows the high level of interest many individual producers have in the health of their pigs. In some cases, pathology at slaughter could indicate the presence of a subclinical problem associated with an EAD.

5.3.9 Disposal methods

Also refer to the **AUSVETPLAN operational manuals *Disposal*** *and* ***Decontamination***, as necessary.

Effluent

Effluent may contain EAD agents. It may be possible to contain effluent for the duration of a quarantine period. Treatment and decontamination may also be possible within existing systems. In most cases, securing the effluent ponds for 1–2 months, depending on daily temperature, after depopulation or use will eliminate any live virus risk.

Livestock should not have access to effluent treatment lagoons and, for at least a month, should not graze areas where effluent has been applied. Effluent should not be applied during an EAD response.

Existing effluent containment systems may potentially be used to contain runoff from cleaning and decontamination activities.

Although effluent can be treated to kill viruses, this has only been done in a laboratory. Use of high levels of sodium hydroxide to decontaminate an effluent pond is a high-risk activity. It risks rendering a functioning anaerobic pond inactive, leading to environmental impacts after restocking.

Manure, sludge and deep litter

Manure has the potential to harbour disease agents, and movement of raw manure off-site does present a risk. However, manure is generally under tight control and treated so that survival and transmission of disease agents are unlikely. Nevertheless, contamination of manure is relevant to the control of foot-and-mouth disease and some other EADs, and may require attention in some circumstances.

Regular cleaning of pens significantly improves animal health and welfare.

Most piggeries will have on-site equipment and expertise in pen cleaning that can be used to minimise the number of extra personnel and pieces of equipment that need to be brought on-site during an EAD response.

Most piggeries will be able to compost manure and other waste material from pens. Composting may be an approved disposal method for contaminated material, such as manure, as specified by the relevant AUSVETPLAN response strategy or CCEAD-agreed Emergency Animal Disease Response Plan.

Disposal of carcasses

Some piggeries have a contingency plan for the disposal of large numbers of pigs and possibly the entire population. The process of deep burial will be based on knowledge of the soil type and profile, and the characteristics of the water table in the immediate vicinity of the piggery. In many cases, the plan will have pre-approval from environmental authorities. Even if pre-approval has been obtained for mass disposal on-site, the relevant environment protection agency will need to be advised that this disposal method is to be used and provide a representative to join the disposal team.

5.3.10 Record keeping

All piggeries should maintain records for commercial reasons (eg invoicing, production planning, performance evaluation, quality control, insurance) and, in some cases, for technical reasons, such as to assist in tracing operational problems. All APIQ✓®-certified piggeries will have good records that

document movement and sources (eg pigs, semen, feed), but there may be minimal or no record keeping on smallholder and noncommercial farms.

Depending on the type of enterprise, records may include details of:

- all movements on and off each premises, including visitors, contractors and vehicles
- the source, number and location of animals of each class
- illness and mortalities
- feed deliveries
- semen deliveries
- truck cleaning and disinfection
- vaccination and medication
- production statistics
- feed consumption
- staff training.

On breeder farms, records that should be kept include the breeder herd of origin, sow identity, date of farrowing and litter parameters, mortality, bodyweight, feed consumption, vaccination, medication, and movement of stock. Water consumption may also be recorded.

Good record keeping will help with tracing potentially infected animals and contaminated things, and may aid assessment of the premises' disease status and any applications for movement permits. Good record keeping is important at all points along the supply chain, including livestock movements both onto and off the site, semen movements and people movements. It is important to keep records readily accessible, current, comprehensive and complete. For records of movements onto and off the premises, this includes keeping details of the origin, transit points, carrier/transporter and vehicle identification, destinations, relevant dates, permissions, items moved, and so on.

Maintaining appropriate livestock identification records, and a current and accurate inventory of livestock, infrastructure and equipment, may also expedite the process of valuing items to be destroyed in an EAD response (and so help with the preparation of claims for compensation).

5.3.11 Water supply

Maintaining an adequate supply of water is important to piggeries. Sufficient capacity is required to supply the pigs with drinking water; to clean pens, yards and vehicles; and for decontamination during an EAD event.

Water quality on piggeries is likely to be high, facilitating its use for cleaning and mixing with disinfectants for decontamination.

5.3.12 Wild and feral animal control

Buildings in piggeries may be bird-proof, and rodent management systems may be in place, but some farms or components (such as ecosheds) are difficult to protect. Free-range farms or farms where sows are kept outdoors are, by their nature, vulnerable to direct contact with wildlife, birds, foxes, feral pigs or feral cats. Because there are so many feral pigs throughout Australia, they pose a high risk to domestic herds. A ringlock fence 1 metre high will reduce the risk of feral pig incursion by an estimated 80%, and this is possible for most farms. However, in areas where feral pig populations are high, more purpose-built fencing is required. This is effective, but expensive.

Water reservoirs, such as dams and effluent ponds, are difficult to protect from waterfowl. They may need to be evaluated during an EAD response to determine whether they are attracting excessive numbers of wild birds.

Appendix 1

EMERGENCY ANIMAL DISEASES OF CONCERN FOR THE PORK INDUSTRY

Relevant features of each of the diseases included in the Emergency Animal Disease Response Agreement[46] and AUSVETPLAN that affect pigs are summarised in Table A.1. For more information, refer to the relevant **AUSVETPLAN response strategy**.

Table A.1 Summary of emergency animal diseases of pigs

Disease	Main species affected	Human health risk	Disease agent (virus category A, B or C[a])	Main transmission pathways	EADRA category
African swine fever	Pigs and other suids	No	Asfivirus A	Direct contact, prohibited pig feed, contact with infected carcasses, fomites, *Ornithodoros* ticks, stable flies	3
Aujeszky's disease	Pigs, cattle, sheep, goats, dogs, cats	No	Varicellovirus A	Direct contact, aerosol, contaminated feed	4
Classical swine fever	Pigs	No	Pestivirus A	Direct contact, prohibited pig feed, semen	3
Foot-and-mouth disease	Cattle, sheep, pigs, camelids	Yes	Aphthovirus B	Direct contact, aerosol, contaminated feed	2
Influenza A virus	Pigs, humans	Yes	Alphainfluenzavirus A	Aerosol, direct contact	4
Japanese encephalitis virus	Pigs, horses	Yes	Flavivirus A	Mosquito-borne	1
Menangle virus	Pigs, flying foxes	Yes	Pararubulavirus A	Bats, aerosols, direct contact	3
Nipah virus	Pigs, bats	Yes	Henipavirus A	Bats, aerosols, direct contact	1
Porcine epidemic diarrhoea	Pigs	No	Alphacoronavirus A	Direct contact, fomites	4

[46] Information about the EAD Response Agreement can be found in the AUSVETPLAN *Overview* and at www.animalhealthaustralia.com.au/eadra.

Disease	Main species affected	Human health risk	Disease agent (virus category A, B or C[a])	Main transmission pathways	EADRA category
Porcine reproductive and respiratory syndrome	Pigs	No	Betaarterivirus A	Direct contact, aerosols, semen	4
Swine vesicular disease	Pigs	No	Enterovirus B	Direct contact	3
Teschen disease	Pigs	No	Enterovirus B	Direct contact	4
Transmissible gastroenteritis virus	Pigs	No	Alphacoronavirus A	Direct contact	4
Trichinellosis	Mammals	Yes	*Trichinella* species	Ingestion of meat containing the encysted intermediate stage	3
Vesicular stomatitis	Cattle, horses, pigs	Yes	Vesiculovirus A	Biting flies, direct contact, aerosols, semen	2

EADRA = Emergency Animal Disease Response Agreement

a Definition of virus categories:

- Category A viruses (intermediate to large size, contain lipid) – very susceptible to detergents and soaps; susceptible to dehydration and often do not persist long unless the environment is moist and cool.
- Category B viruses (smaller, no lipid, more hydrophilic; eg picornaviruses and parvoviruses) – relatively resistant to lipophilic disinfectants such as detergents. Less susceptible than viruses in Category A. Classical bactericides, such as quaternary ammonium compounds and phenolics, are not effective against these viruses.
- Category C viruses (intermediate in size, no lipid; eg adenoviruses and reoviruses) – intermediate between Categories A and B in sensitivity to the best antiviral disinfectants, such as hypochlorites, alkalis, oxidising agents (eg Virkon®) and aldehydes.

Appendix 2

DETAILS OF TYPES OF PIGGERIES, HOUSING SYSTEMS AND MANAGEMENT SYSTEMS

Types of piggeries

Farrow-to-finish piggeries

Farrow-to-finish is the conventional type of intensive pig farm, where breeding, farrowing, weaning and growing/finishing of pigs all occur on one farm until sale, at around 18–26 weeks of age. Many farms also have quarantine facilities where incoming stock (if the farm does not breed its own replacements) are housed for a short time (usually 4–6 weeks) before they come into the herd.

In a farrow-to-finish herd, the total inventory at any one time is about 10 times the sow herd size. Hence, a 500-sow farrow-to-finish herd will hold about 5000 pigs at any one time. Depending on the business structure, the growing pigs may be spread over multiple sites.

Many farrow-to-finish piggeries operate as 'closed herds', in which replacement breeding stock are selected from within the herd or are derived from artificial insemination (AI). Other piggeries introduce breeding stock from a single commercial supplier, or use some introductions and some of their own pigs for breeding. For example, they may buy in grandparent gilts from a regular high-health-status supplier to produce their own commercial parent sows, which farrow the pigs that will eventually be sold for slaughter. These farms will artificially inseminate the grandparent gilts with semen from a maternal-line boar to produce the parent gilts. They will then mate the parent gilts by AI to a meat-line boar to produce the slaughter generation.

As a rule, 12–15% of the sow herd is needed as replacement breeding stock. Cull sows are mostly sold direct to slaughter, but some are sold through saleyards. The size of the breeding herd limits the number of matings; hence, fertility, survival, feed efficiency and weight at slaughter drive profit.

AI is used on most farms for most matings. Sows are inseminated in the week after weaning the previous litter. The semen is sourced from a purpose-built, biosecure AI centre two or three times per week. Some large farms have their own AI units, and collect and process twice weekly. In contrast to the dairy industry, farm staff inseminate the sows.

The breeding stage includes the boars and gilts, dry sows waiting for either confirmation of pregnancy or mating, and the gilt pool (see below) and gilt development pool. Boars, where they are kept, are usually housed individually, whereas dry sows may be housed in individual stalls, or loose housed in group pens or yards (or in a combination of these). Four out of five sows in Australia are housed loosely.

Gilts are generally group housed. The breeder gilts are collectively known as the 'gilt pool' (ie a group of young females selected as potential replacements for the breeding herd). If the herd has a within-herd replacement program, these gilts will be selected from, and then moved out of, the grower–finisher area. They remain in the gilt pool until all preparation (eg vaccination against erysipelas, leptospirosis and parvovirus; tagging; puberty stimulation) is complete and they have achieved target mating age and weight (30 weeks; 130 kg). If gilts and young boars are purchased, they will remain in a quarantine area outside the main farm perimeter for 4–6 weeks to undergo acclimatisation procedures; this ensures that purchased gilts do not bring disease onto the farm and are vaccinated to protect them from diseases endemic to the herd.

The way sows are housed is dictated in part by the welfare code and in part by contractual elements in place with supermarkets for the sale of pork. In Australia, the majority of sows and gilts are kept in loose housing from at least 5 days after service (the last mating) until 1 week before farrowing.

During lactation, each sow and litter is generally housed in an individual pen (referred to as a farrowing pen) that provides protection from draughts. The creep area is separated from the main stall by side rails to protect the piglets from being crushed by the sow, and the area also provides the piglets with exclusive access to additional feed and heat.

Common infectious diseases in the farrowing house include enterotoxigenic *Escherichia coli*, *Glaesserella parasuis* (Glässer's disease) and *Streptococcus suis*. The last two occur more often in the weaner house, but they start in the younger age groups. Coccidial organisms (*Cystoisospora suis)* are nearly always present, but usually controlled by prophylactic toltrazuril at 4–5 days of age.

After farrowing and within the first 48 hours after birth, the pigs are processed. Depending on the farm, this may involve docking tails, administering iron injections, notching ears and castrating males. The last is disappearing as producers opt for immunocastration using a gonadotropin-releasing hormone as the antigen. Clipping teeth has also disappeared from the farrowing house routine as producers learn how to better feed the sows and reduce unnecessary fostering, and hence reduce fighting between neonates.

Pigs are commonly weaned at 3–4 weeks of age into a purpose-built weaner house or straw-bedded shelter. Weaners can be stressed by the change in diet (from milk to solid feed), mixing with other pigs and environmental changes, all of which increase their susceptibility to disease. Newly weaned pigs are housed in a warm, dry, draught-free environment to counter these abrupt changes. They are fed a special weaner diet balanced for amino acids and energy. Alternatively, water medication may be used soon after weaning to control postweaning *E. coli* infections and proliferative enteritis at about 7–10 weeks of age. Group sizes depend on the facility. They range from as many as 1000 pigs in ecosheds to as few as 15–20 pigs in a pen. Group size presents an issue in disease control for the industry as it grapples with the tension between building design efficiency, pig flow, group size and disease control.

The most important diseases after weaning and through the growth phases include postweaning enterotoxigenic *E. coli*, Glässer's disease, streptococcal septicaemia, proliferative enteritis (*Lawsonia intracellularis*), erysipelas (*Erysipelothrix rhusiopathiae*), enzootic pneumonia (*Mycoplasma hyopneumoniae*), *Actinobacillus pleuropneumoniae*, swine dysentery (*Brachyspira hyodysenteriae*) and porcine circovirus type 2. Internal and external parasites are present on many farms, but rarely cause problems. Vaccines (autogenous or registered) are available for the control and prevention of porcine circovirus, *G. parasuis*, *E. rhusiopathiae, M. hyopneumoniae*, *A. pleuropneumoniae* and *L. intracellularis*.

By 8–10 weeks of age, the pigs move to a grower facility. More space per pig is provided, and the diets typically change again. Grower pigs require a lower degree of environmental precision than newly weaned pigs. They are often fed in 'phases', so that the diet is tailored to provide optimal nutrition for each growth stage. Throughout the growth stage, pigs are fed ad libitum to maintain maximum growth rates and feed efficiency.

Males and females can be separated at this stage. Depending on the farm practices, the pigs may stay in a group until they are sold. If housed in straw-based shelters as growers, they may be moved to a larger shelter, or the group will be split at about 16–18 weeks of age. The first heavy pigs for sale may be removed at about 18 weeks. Practices vary considerably.

Pigs turned off as baconers generally have a liveweight of 90–100 kg (70–78 kg carcase weight, but some may be higher), depending on the market and the contract. Most are subject to tightly managed specifications by purchasers, with little room to compromise. Pigs that do not meet this specification for any reason will be heavily discounted in value. This means that anything that results in a finisher pig being held back from market by even a few days could result in heavy financial losses to the owner. Clearly, there are important implications for pork production businesses that find themselves in a restricted or control area during an emergency animal disease (EAD) outbreak and unable to move pigs for several days or weeks.

Every week of the year, on most farms, a new group is mated. This sets activities in motion so that, in 16 weeks, that group is moved into the farrowing house, a group is weaned, a group is moved from the nursery to the grow/finish section, and a group is sold. The exception occurs on farms that produce in batches, where the same moves occur but at 3–5-week intervals. On these sites, the urgency to move is even higher and the schedules tighter; in an EAD response, there will be extreme tension between the need to comply with disease control regulatory measures, the demand for space for the next batch coming through, the ability to move pigs to slaughter or to another site for the next production stage, and the need to comply with the welfare code regarding space allowance. There is significant potential for rapidly escalating animal welfare crises where pig movements are delayed.

The pigs are transported to an abattoir, usually early in the morning, for slaughter the same day. Feed and water restrictions apply before transport. Where significant distances are travelled, the pigs will be rested in a lairage for 12 hours and killed the following day. Pigs move freely between Queensland, New South Wales, South Australia and Victoria for slaughter.

Feed is delivered daily, weekly or monthly, depending on scale. Biosecurity associated with silo positioning varies considerably. Modern farms have the silos positioned at the perimeter so there is no need for trucks and drivers to enter the farm compound. Older farms may require the feed transport to enter the farm compound. In general, these businesses have developed a biosecurity protocol, or the feed supply company follows an agreed, established protocol for its drivers.

Breeder piggeries

The breeder piggery is a production system in which only gilts, sows, boars and suckling piglets are farmed at the one site. Management focuses on mating, pregnancy, farrowing and weaning. After farrowing and a period of lactation (typically 3–4 weeks), piglets are weaned and sent off-site to a grower–finisher site. Every time a new group of sows is introduced to farrow, sows in the system must be weaned and their progeny must be moved off-site. On most farms, there is limited capacity to hold pigs for an extended period; hence, stock standstill orders have a substantial impact on segmented farms.

Generally, boars are housed individually, whereas dry sows are housed in individual stalls or group pens. In Australia, the majority of sows and gilts are kept in loose housing from at least 5 days after service (the last mating) until 1 week before farrowing.

AI is used on most sows most of the time on most farms. The few boars that are present are used for heat detection. Any interruption to this seriously affects pig supply in 9 months time.

Weaner piggeries

A weaner piggery includes only weaner pigs, generally from 3–4 weeks to 8–10 weeks of age. Groups of pigs are generally moved into all-in-all-out rooms or sheds each week. Some farms run on a batch basis, and the whole site is filled at the same time. On the largest farms in Australia, pigs are moved onto a weaner site from two or three breeder sites that generally have a similar health status. On the largest farms, thousands of pigs are transported each week.

Specialist weaner production systems are popular with contract growers using purpose-built, environmentally controlled facilities or deep-litter housing.

Grower–finisher piggeries

A grower–finisher piggery includes grower pigs (about 10–16 weeks of age) and finisher pigs (from about 16 weeks to 22–24 weeks of age). They may be housed in conventional sheds, deep-litter housing, outdoors, or a combination of these.

Typically, the weight of pigs is 25–65 kg during the grower period and 65–95 kg during the finisher period. The number of pigs housed within a shed or shelter is periodically adjusted to allow for their increasing weight and size.

The preferred housing is based on all-in-all-out or batch-production systems. These have less potential for entry of a disease than a piggery with progressive arrivals. Straw-bedded shelters lend themselves well to these systems. One shelter for 200–400 pigs is common, but large sizes may create problems when sorting the pigs for sale.

Growing and finishing pigs have broader environmental tolerance. They are often fed in 'phases', so that the diet is tailored to provide optimal nutrition for each growth stage.

Finisher farms lend themselves well to contracting schemes. They are often situated on grain farms that have space and surplus labour, can use effluent from the piggery on crops, and are in proximity to processing facilities (abattoirs).

Multisite piggeries

Larger piggeries are typically structured as multisite operations, where one or more breeder farms provide weaners to nursery and weaner sites at 3–4 weeks of age, and then to grower and finisher sites. For example, there may be two- or three-stage grower chains of linked properties comprising weaners being transported from the breeding site to a nursery weaner site for 5–7 weeks, and from there to grower–finisher farms (10–17 weeks and 17–24 weeks, respectively). A multisite piggery of this type may have 5–15 separate piggery units separated by 10–150 km and extending over state borders. Approximately 40–60% of pigs move between properties during their lifetimes – in addition to those going to slaughter.

The multiple grow-out sites may be owned within one group but are more commonly owned by individual contract growers who manage the pigs on an agistment basis according to protocols prepared by the parent company.

Such multisite operations involve continual pig movements. They generally use their own transport or engage a single transport company that uses vehicles exclusive to that operation.

This complexity is a significant feature of the pork industry and needs to be well understood if an EAD affecting the industry is to be effectively and efficiently managed.

Types of housing systems

Conventional indoor housing

Conventional indoor housing is a traditional intensive production system in which all animals are confined indoors within a structure designed to modify the environment for all or part of the production cycle. The pigs are fed on prepared or manufactured feedstuffs or rations to meet their nutritional requirements.

Conventional sheds suit all classes of pig. The pigs are usually separated into pens of varying group sizes. The flooring is usually partly or fully slatted, or has open-channel dunging areas. For sheds with slatted flooring, spilt feed and water, urine and faeces fall through the slats into underfloor channels or pits. These are regularly flushed to remove effluent from the sheds.

The sheds may be environmentally controlled or naturally ventilated, and incorporate varying levels of automation (eg partial feeding stalls, electronic feeding stations, trickle and floor feeding, climate controls for protection from summer heat or winter draughts).

The stocking rate (square metre/pig) and stocking density (cubic metre/pig) are important; it is difficult to maintain good hygiene and air quality unless there is adherence to standards. Maximum

stocking rates for each class of pig are provided in the *Model code of Practice for the welfare of animals: pigs* (3rd edition)[47] and the *Companion handbook to the model code of practice for the welfare of pigs* (3rd edition),[48] which allow 20–30% of space for a dunging area, such as slats. The general practice is for pigs to be provided with a little more space than these minimums.

Deep-litter housing

Deep-litter housing in sheds (ecosheds) is widely used for accommodating compatible groups of pigs, such as weaners, growers, finishers and gestating sows. These sheds are frequently open-ended buildings with a poly-tarp-hoop roof and gates to prevent the pigs moving out of either end. They are established on a specially prepared earth floor or a reinforced concrete slab. Low-permeability flooring makes cleaning easier and prevents nutrients from leaching into groundwater. Variations include converted conventional sheds or skillion-roof sheds with bedding over the flooring.

Bedding varies according to price and availability. It may be fibrous (straw) or particulate (rice hulls or sawdust), or made of similar loose material that absorbs manure, eliminating the need to use water for cleaning. Regular top-up of bedding is needed, and stocking densities must be carefully managed to maintain dry, low-odour conditions within sheds.

Although ecosheds may be relatively inexpensive to build and may provide some welfare benefits, bedding may be difficult to buy and expensive during drought years, particularly for finisher pigs and dry sows, which require more bedding than other pig classes.

Weaners, growers and finishers generally move through these sheds in batches (all-in-all-out), with spent bedding cleaned out only after each batch. Spent bedding also requires management.

Outdoor or free-range facilities

Environmental factors, combined with high summer temperatures and seasonal infertility, generally restrict populations of outdoor pigs in Australia to coastal areas in Western Australia and New South Wales, and areas in southern Victoria. The outdoor sow population is estimated at 25 000–30 000 sows. A small proportion of these piggeries are referred to as 'extensive piggeries', because the animals rely primarily on foraging and grazing, rather than on supplementary feed, to meet more than 50% of their nutritional requirements.

Herds are kept in small paddocks (rotational) or enclosures (feedlot), sometimes with simple communal shelters for dry sows, kennels for weaners, and individual huts for farrowing sows and nursing sows. They may be managed in static groups (no new additions are made to the group after its formation) or dynamic groups (animals are continually added and removed from the group).

In a rotational outdoor piggery, pigs are kept in small paddocks, with huts or other basic housing. The paddocks may be rotated with a pasture or cropping phase. During the stocked phase, the pigs are supplied with prepared feed, water, wallows and foraging. During the non-pig phase, the area grows pastures or crops that are harvested to remove the nutrients deposited in pig manure during the stocked phase.

Feedlot outdoor piggeries continuously accommodate pigs in permanent outdoor enclosures. These enclosures must be located within a controlled drainage area so that all stormwater runoff is controlled and kept separate from stormwater runoff from areas outside the pig enclosures. The base of the enclosure must be sealed to prevent nutrients and salts from leaching into groundwater.

Generally, sows are housed outdoors in a shared hut within a paddock and fed pelleted diets. The sites are rotated about every 2 years. The sows farrow in huts, but the piglets are weaned into straw-

[47] www.publish.csiro.au/book/5698
[48] https://australianpork.com.au/sites/default/files/2021-07/Companion-to-the-Model-Code.pdf

bedded shelters. Systems vary, but by 6–8 weeks of age the piglets have been moved off-site to a growing unit.

Outdoor systems were developed as a low-cost intervention system. They rely on efficient management, putting sufficient sows before the boars to meet production targets, high-quality diets and good survival. The relatively low cost of keeping a sow is used to hold a surplus to ensure that weaned targets are met, and grower facilities are filled. This is maintained on some farms, but others have introduced management procedures more common to indoor intensive farms than outdoor farms, such as AI and trough feeding for sows to improve the efficiency of production.

The design of many free-range enterprises allows access to pigs by wild birds, feral animals, vermin and aerosols. Most such enterprises have multi-aged herds that are often held in adjacent paddocks, so many of the principles of separation and between-herd hygiene cannot be practised. Other hygiene and biosecurity procedures may be the same as on other commercial farms, but commercial farms have a higher emphasis on preventing the entry of wild birds, feral animals and vermin. Generally, free-range farms are at greater risk of biosecurity breaches by feral pigs and can pose environmental risks if not carefully managed.

Types of piggery management

Commercial piggeries

Commercial piggeries are businesses with substantial fixed investment in the premises and a large operating expenditure. They are subject to considerable variations in the price of their inputs, and the value of their product in domestic and international markets. They use expert knowledge and management skills to balance these factors, while ensuring that the day-to-day operation runs smoothly.

These enterprises vary greatly in size and in the way they operate. There are many combinations of housing, production phases and locations, and associated variations in the nature and size of risks, which can all be associated with an EAD outbreak.

Integrated piggeries

The largest pig producers in Australia operate as vertically integrated supply-chain consortiums, combining dedicated breeder farms, contract growers, feedmills, and integrated slaughtering and processing facilities.

Only pigs under the same ownership are generally introduced to the complex. The exceptions are periodic movements of pigs from the single-seed stock-breeder supplier to the sow farm. These movements are planned to occur each week of the year and are independent of market demand. They are affected by season (summer) because this affects fertility. Producers try to counter this effect by mating more sows.

These integrated multisite systems provide sophisticated support services. They have veterinary, nutritional, genetic, management and training support, and employ biosecurity measures that exceed the requirements of the industry code of practice. They may be high-health-status herds but are equally likely to have 'conventional' health status. High-health-status herds are free from *Mycoplasma hyopneumoniae*, swine dysentery, atrophic rhinitis, internal and external parasites, and *Actinobacillus pleuropneumoniae*. Conventional-health-status herds carry several or all these diseases, but generally still operate under strict biosecurity protocols to minimise further introductions of other diseases or disease strains.

Piggeries run by contract growers and breeders

Contractors do not own the pigs they farm but meet a client's requirements for production of pigmeat suitable to their market or for supply of breeding stock according to specification. The precise arrangements vary, but generally one party provides the labour and housing facilities, and the other provides the feed, pigs and technical knowledge, and sells or slaughters the pigs. Some contracting schemes pay a set weekly amount, while others pay bonuses that depend on feed efficiency and survival rates. Because the health status of herds may vary, complex biosecurity arrangements are generally in place.

The size of contract farms varies. In the largest systems, semen may be transported from an in-house semen centre to contract breeder herds. Gilts may be transported from contract multiplication herds to contract breeder sites. Thus, there may be regular movement of animals and semen throughout the enterprise.

Smallholder and noncommercial growers

Smallholder producers are generally considered to be those with fewer than 50 sows. They include owners who may keep only one pig as a pet and those with a few for personal consumption. Many of this group are noncommercial in that they do not farm for profit and may have little interest in the business or technical aspects of pig farming.

As a group, smallholders and noncommercial farms present many challenges to disease management because their knowledge of pig diseases and ability to recognise an exotic disease may be minimal. They may have no interest in, or capability to implement and manage, the many aspects of biosecurity. Many of the smaller owners are transient, and a significant number (33%; Schembri et al 2010ab) have never had contact with a veterinarian. Communication with this group is difficult, and it is challenging to introduce improved practices. Other complications are variation in state legislation (mainly relating to requirements for identification and movement documentation), a lack of requirement for vendors and purchasers to identify themselves, poor pig identification at saleyards where many progeny from these operations are sold (often weaners for cash), and minimal knowledge of the bans on prohibited pig feed.

Pigs are kept under a range of housing systems but are commonly outdoors. All these enterprises should register with Australian Pork Limited (through the PigPass system) and the state government for environmental and biosecurity purposes, and ensure that they have any necessary local council approvals; however, this is rarely done. As a result, many of these piggeries are unknown to authorities or the industry. In addition, it is highly likely that they will purchase pigs from markets, will not use any quarantine on arrival, will not maintain records of pig movements on or off the property, and will not monitor health of the pigs.

A 2015 study (Schembri et al 2015) surveyed 104 producers selling pigs to peri-urban saleyards in eastern Australia. Backyard operations (<20 sows) were undertaken by 60.6% of participants, followed by small-scale pig operations (21–100 sows; 28.8%). Few producers (16.3%) reported residing in close proximity (<5 km) to commercial operations, and fewer rural producers had neighbouring hobby pig operations within 5 km of their property. Motivation for keeping pigs was significantly associated with a number of biosecurity practices. Producers who kept pigs for primary income were more likely to use footwear precautions and ask visitors about prior pig contacts. Approximately 40% of backyard and small-scale producers reported not having any quarantine practices in place for incoming pigs, compared with only 9.1% among larger producers. The main reasons cited for not adopting on-farm biosecurity practices in this study included having no need on their property (43.1%), and a lack of information and support (by the industry and/or authorities; 18.5%). Up to three-quarters of all producers maintained an open breeding herd, regularly introducing new pigs to the main herd.

Differing management and biosecurity practices, as well as the motivations of producers who keep pigs in small numbers and trade pigs at saleyards, need to be taken into account in the development of successful biosecurity extension programs for this sector of the Australian pork industry.

In 2010, a stream of APIQ✓® certification, designed for smallholders, was introduced for producers who keep 50 or fewer sows or sell up to 1000 pigs in a year.[49] It requires smallholders to meet the same standards as large holders but supports smallholders with manuals and record-keeping processes that suit smaller production systems.

Batch-production systems (all-in-all-out)

Many piggeries manage their pigs in batches as a key component of health management. Batches of pigs of the same age or class are housed together. They may be weaners, growers or finishers of the same age, or they may be sows due to farrow during the same week.

Batches may be based on individual units at a site or on an entire site. The process requires all pigs to be removed from a shed or site before the next group of pigs is moved in, with the facilities being thoroughly cleaned between each batch. This results in an 'all-in-all-out' process. The time between batches varies significantly, depending on the type of piggery, its size and the intensity of throughput. The flexibility of the batch system will also vary, depending on the number of sheds or rooms available and the flow of pigs. Batches may be managed so that one shed or room is emptied, cleaned and disinfected each week. In multisite piggeries, 1–4 batches per week may leave a breeder farm. In large piggeries, a 'week-of-pigs' may be the basic management unit through which the various units are managed until consignment to the abattoir.

The quality of cleaning that can be achieved with batch production contributes to improved growth rates and reduced levels of disease. A high-pressure hose can be used without the risk of wetting pigs or spreading microorganisms to other pigs. However, the opportunity to rest sheds in intensive, large-scale piggeries may be limited to only a few days.

Batch production means that any disease agent that is present should remain confined to that batch. Other batches of pigs present on a farm may not need to be destroyed (where that is the default policy) as they may be epidemiologically discrete.

[49] www.apiq.com.au/certification/if-you-are-a-small-holder

Glossary

Standard AUSVETPLAN terms

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).
Animal Health Committee	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, Water and the Environment. 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. *See also* National Biosecurity Committee
Animal products	Meat, meat products and other products of animal origin (eg eggs, milk) for human consumption or for use in animal feedstuff.
Approved disposal site	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.
Approved processing facility	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.
At-risk premises	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.
Australian Chief Veterinary Officer	The nominated senior veterinarian in the Australian Government Department of Agriculture, Water and the Environment who manages international animal health commitments and the Australian Government's response to an animal disease outbreak. *See also* Chief veterinary officer
AUSVETPLAN	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.
Carcase	The body of an animal slaughtered for food.
Carcass	The body of an animal that died in the field.
Chief veterinary officer (CVO)	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. *See also* Australian Chief Veterinary Officer

Compartmentalisation	The process of defining, implementing and maintaining one or more disease-free establishments under a common biosecurity management system in accordance with OIE guidelines, based on applied biosecurity measures and surveillance, to facilitate disease control and/or trade.
Compensation	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. *See also* Cost-sharing arrangements, Emergency Animal Disease Response Agreement
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	Arrangements agreed between governments (national and state/territory) and livestock industries for sharing the costs of emergency animal disease responses. *See also* Compensation, Emergency Animal Disease Response Agreement
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.
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.
Disinsectation	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.
Emergency animal disease	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. *See also* Endemic animal disease, Exotic animal disease
Emergency Animal Disease Response Agreement	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. *See also* Compensation, Cost-sharing arrangements
Endemic animal disease	A disease affecting animals (which may include humans) that is known to occur in Australia. *See also* Emergency animal disease, Exotic animal disease
Enterprise	*See* Risk enterprise
Enzyme-linked immunosorbent assay (ELISA)	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.
Epidemiological investigation	An investigation to identify and qualify the risk factors associated with the disease. *See also* Veterinary investigation
Epidemiology	The study of disease in populations and of factors that determine its occurrence.
Exotic animal disease	A disease affecting animals (which may include humans) that does not normally occur in Australia. *See also* Emergency animal disease, Endemic animal disease
Exotic fauna/feral animals	*See* Wild animals
Fomites	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.

General permit	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. *See also* Special permit
In-contact animals	Animals that have had close contact with infected animals, such as noninfected animals in the same group as infected animals.
Incubation period	The period that elapses between the introduction of a pathogen into an animal and the first clinical signs of the disease.
Index case	The first case of the disease to be diagnosed in a disease outbreak. *See also* Index property
Index property	The property on which the index case is found. *See also* Index case
Infected premises (IP)	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.
Local control centre	An emergency operations centre responsible for the command and control of field operations in a defined area.
Monitoring	Routine collection of data for assessing the health status of a population or the level of contamination of a site for remediation purposes. *See also* Surveillance
Movement control	Restrictions placed on the movement of animals, people and other things to prevent the spread of disease.
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, Water and the Environment 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
OIE Terrestrial Code	OIE *Terrestrial animal health code*. Describes standards for safe international trade in animals and animal products. Revised

	annually and published on the internet at: www.oie.int/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access.
OIE Terrestrial Manual	OIE *Manual of diagnostic tests and vaccines for terrestrial animals*. 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: https://www.oie.int/en/what-we-do/standards/codes-and-manuals/terrestrial-manual-online-access.
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.
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, TPs, 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.
Sensitivity	The proportion of truly positive units that are correctly identified as positive by a test. *See also* 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. *See also* General permit
Specificity	The proportion of truly negative units that are correctly identified as negative by a test. *See also* 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.
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	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. or An animal not known to have been exposed to a disease agent but showing clinical signs requiring differential diagnosis.
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).
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 by-products either of Australian provenance or legally imported for stockfeed use into Australia. (ii) Material containing flesh, bones, blood, offal or mammal carcases which is treated by an approved process.[1] (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.
Swill feeding	Also known as 'feeding prohibited pig feed', it includes: • 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. This definition was endorsed by the Agriculture Ministers' Council through AGMIN OOS 04/2014.
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.

– 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 biological vector is one in which the infectious agent must develop or multiply before becoming infective to a recipient host. A mechanical vector is one that transmits an infectious agent from one host to another but is not essential to the life cycle 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).
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 OIE 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

Manual-specific abbreviations

Abbreviation	Full title
AI	artificial insemination
APIQ✓®	Australian Pork Industry Quality Assurance Program
APL	Australian Pork Limited
FMD	foot-and-mouth disease
NLIS	National Livestock Identification System
NVD	National Vendor Declaration
PIC	Property Identification Code

Standard AUSVETPLAN abbreviations

Abbreviation	Full title
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

Abbreviation	Full title
IETS	International Embryo Technology Society
IP	infected premises
LCC	local control centre
NMG	National Management Group
OA	outside area
OIE	World Organisation for Animal Health
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
ZP	zero susceptible stock premises

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