AUSTRALIAN VETERINARY EMERGENCY PLAN

AUSVETPLAN

Enterprise Manual

Zoos

Version 3.0, 2014

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.

Agriculture Ministers' Forum

This enterprise manual forms part of:

AUSVETPLAN Edition 3

This strategy will be reviewed regularly. Suggestions and recommendations for amendments should be forwarded to:

AUSVETPLAN — Animal Health Australia
Executive Manager, Emergency Preparedness and Response
Suite 15, 26–28 Napier Close
Deakin ACT 2600
Tel: 02 6232 5522; Fax: 02 6232 5511
email: admin@animalhealthaustralia.com.au

Approved citation: Animal Health Australia (2014). Enterprise manual: Zoos (Version 3.0). Australian Veterinary Emergency Plan (AUSVETPLAN), Edition 3, Agriculture Ministers' Forum, Canberra, ACT.

Publication record:
Edition 1: 1991
Edition 2:
Version 2.0, 1996 (interim document)
Version 2.1, 1998 (final document)
Edition 3:
Version 3.0, 2014 (major update and inclusion of new cost-sharing arrangements)

AUSVETPLAN is available on the internet at:
www.animalhealthaustralia.com.au

ISBN 0 642 24506 1 (printed version)
ISBN 1 876 71438 7 (electronic version)

DISEASE WATCH HOTLINE

1800 675 888

The 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.

Preface

This enterprise manual for zoos and fauna parks constitutes part of the **Australian Veterinary Emergency Plan**, or **AUSVETPLAN (Edition 3)**. AUSVETPLAN is a coordinated national response plan for the management and, wherever possible, eradication of exotic disease incursions and outbreaks of certain emerging or endemic animal diseases. The term emergency animal disease (EAD) is used to collectively describe these disease categories.

Enterprise manuals, a component of AUSVETPLAN, are prepared for animal industries in which the risk of harm from an EAD is expected to be higher than normal. For example, the way in which animals are managed may result in a higher likelihood of rapid spread of a disease agent, and thus impact on the response to an outbreak (known as an EAD response) and its associated costs.

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. Although zoos are not considered risk enterprises to other premises and are unlikely to affect the nature of the outbreak, zoos need to consider EAD preparedness for their own facilities.

This manual is aimed at both government officers and zoo industry personnel who may be involved in EAD preparedness. 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, and gives an important overview of the zoo industry. For industry personnel, including owners or managers, the manual provides guidelines on their responsibilities during an EAD outbreak, 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.

Publication of this manual follows widespread consultation within the zoo industry and with government.

In this manual, text placed in square brackets [xxx] indicates that that aspect of the manual remains contentious 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.

Guidelines for the field implementation of AUSVETPLAN are contained in the disease strategies, operational manuals, management manuals and wild animal manual. Industry-specific information is given in the relevant enterprise manuals. The full list of AUSVETPLAN manuals that may need to be accessed in an emergency is shown below:

AUSVETPLAN manuals[1]

Disease strategies
- Individual strategies for most of the diseases listed in the EADRA
- Bee diseases and pests
- Response policy briefs (for diseases not covered by individual manuals)

Operational procedures manuals
- Decontamination
- Destruction of animals
- Disposal
- Livestock welfare and management
- Public relations
- Valuation and compensation

Enterprise manuals
- Artificial breeding centres
- Feedlots
- Meat processing
- Pig industry
- Poultry industry
- Saleyards and transport
- Zoos

Management manuals
- Control centres management (Parts 1 and 2)
- Laboratory preparedness

Wild animal response strategy

Summary document

EADRA = *Government and Livestock Industry Cost Sharing Deed in Respect of Emergency Animal Disease Responses*

Scope of this manual

This Zoos Enterprise Manual provides an overview of the zoo industry and the operations of zoos in Australia (Section 2). Features of zoos that are relevant to disease control or eradication are described, and guidelines are provided on managing an EAD in a zoo. Section 3 provides information on EAD management and the procedures that would be used during an EAD response. It provides information on strategies that may be adopted to improve EAD preparedness and guidelines for preparing an EAD response plan.

For the purposes of this manual, the term *zoo* refers to any zoo, fauna park, wildlife park or other facility housing nondomestic animals, and encompasses all the animals held there, including exotic, native and domestic species. This manual addresses specific risks associated with zoos and similar facilities.

The manual does not address specific operations and risks associated with circuses, wildlife rehabilitation facilities (other than those associated with a registered zoo), mobile zoos (other than those that form part of an established traditional zoo), research facilities holding exotic or native animals, exotic or native animals kept by individuals as pets, private avicultural or private herpetological enterprises, unlicensed enterprises operating as zoos, or exotic and native animal industries (eg camel, ostrich, crocodile and buffalo farms). Although much of the information and processes outlined in this manual may be relevant to other enterprises holding native and exotic animals, the specific operations and risks associated with those non-zoo enterprises are not addressed in this manual.

---

1 The complete series of AUSVETPLAN documents is available on the internet at www.animalhealthaustralia.com.au/programs/emergency-animal-disease-preparedness/ausvetplan.

Aquatic enterprises (commercial aquariums) are addressed in AQUAVETPLAN and are not part of the scope of the Zoos Enterprise Manual. Land and marine invertebrates are also outside the scope of this manual.

For this manual to become an effective document, it is important that the proposed strategies are incorporated into routine zoo protocols and staff training. Individual zoos should develop their own organisation-specific plans to support this manual.

The manual should be read in association with other AUSVETPLAN documents, and the *National Zoo Biosecurity Manual* (Reiss and Woods 2011), which provides a guide to good biosecurity practices in Australian zoos.

Nationally agreed standard operating procedures

Nationally agreed standard operating procedures[2] have been developed for use by jurisdictions during responses to EAD incidents and emergencies. These procedures underpin elements of AUSVETPLAN and describe in detail specific actions undertaken during a response to an incident.

[2] www.animalhealthaustralia.com.au/programs/emergency-animal-disease-preparedness/nasops

Contents

1 Disease management and emergency animal disease preparedness

1.1 Australia's animal health services

In Australia, each state and territory has operational responsibility for the control and eradication of animal diseases within its borders. Animal health authorities administer legislation relating to responses to emergency animal diseases (EADs), including movement controls, treatment, vaccination, destruction, disposal, decontamination and compensation. Inspectors have wide powers, including the ability to enter premises, examine records, order livestock musters, control animal movements, request that animals or products be submitted for testing, and isolate and destroy diseased or suspected diseased animals. The Australian Government advises on, and coordinates, national animal health policy, and is responsible for quarantine and international animal health matters (including export certification and trade negotiations), and disease reporting to the World Organisation for Animal Health (OIE).

1.2 Principles of emergency animal disease management

In Australia, the traditional role of governments (Australian, and state and territory) in managing animal health is complemented by a close association between government and the livestock and animal industries. National animal health priorities are determined in consultation with animal industries, which participate in policy development, support targeted activities and contribute to emergency responses.

As part of their preparedness arrangements, state and territory animal health authorities develop operational plans for managing EADs that are consistent with AUSVETPLAN and their own legislative framework. These plans are made in conjunction with the state or territory emergency management organisation and support agencies, and contain considerable detail on the various procedures described in this manual.

EAD responses are planned and implemented at three levels — national, state or territory, and local. In the event of an EAD outbreak, relevant state or territory animal health officials manage all aspects of its control and eradication according to a nationally agreed plan. They work with livestock and other animal industry liaison officers (ILOs), and the owners and managers of premises within declared areas to resolve the outbreak and return enterprises to normal operations.

The chief veterinary officer (CVO) of the state or territory in which an EAD outbreak occurs is responsible for implementing the endorsed disease control measures. The CVO works with the Consultative Committee on Emergency Animal Diseases (CCEAD), which provides the link between the Australian Government, the state and territory governments, and the relevant livestock and animal industries for technical and veterinary decision making during EAD outbreaks.

The CCEAD advises a high-level national management group (NMG) on response policy. The NMG determines whether an agreement to share the costs of a response between Australia's governments and the relevant livestock or other animal industries should be invoked. The NMG manages national policy and resourcing of the EAD response. Both the CCEAD and the NMG base their decisions on current information provided by the affected state or territory, and on guidance provided in AUSVETPLAN.

1.3 Emergency Animal Disease Response Agreement

The EAD Response Agreement (EADRA)[3] provides a framework for the Australian Government, the state and territory governments, and the major livestock industries to manage EAD outbreaks cooperatively. It describes the funding of eligible EAD responses, and the sharing of the costs between government and the affected livestock industries.

The zoo industry is not currently a signatory to the EADRA.

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. An EAD response is initially funded by the affected state or territory, with refunds made by the Australian Government on behalf of all funding parties according to an agreed formula for the particular disease, as described in the EADRA. The NMG makes decisions about activation and use of cost-sharing arrangements during an EAD response.

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.

The EADRA specifies that the lead agency in the state where the EAD outbreak occurs must develop an EAD Response Plan. The plan must be consistent with the relevant AUSVETPLAN **Disease Strategy**, endorsed by the CCEAD and approved by the NMG.

The EADRA includes a firm commitment by the parties to implement biosecurity plans. Animal Health Australia manages these plans as part of its National Disease Mitigation Program.

Table 1.1 describes the four disease categories and their respective shared-cost arrangement.

---

[3] 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/programs/emergency-animal-disease-preparedness/ead-response-agreement.

Table 1.1 Disease categories and shared-cost arrangements

Category	Shared-cost arrangement
1	100% government
2	80% government 20% industry
3	50% government 50% industry
4	20% government 80% industry

1.4 AUSVETPLAN

AUSVETPLAN is the national contingency planning framework for the management of EAD incidents in Australia. The plan ensures coherent operations and procedures in the management of an EAD incident among national, state and territory animal health authorities and emergency management organisations.

Animal Health Australia, the custodian of AUSVETPLAN, works closely with Australian, state and territory governments, and livestock and other animal industries to determine priorities and regularly review AUSVETPLAN to ensure that it is current and appropriate. Finalised manuals that deal with response policy are endorsed by governments.

Everyone involved in the EAD preparedness of zoos should understand the nature and structure of AUSVETPLAN. Enterprise manuals do not stand alone and must be read in association with other AUSVETPLAN documents.[4]

Readers should also be aware of:

- nationally agreed standard operating procedures (NASOPs)[5] that have been developed for use by jurisdictions during responses to EAD incidents and emergencies
- the standard operating procedures that are prepared by the appropriate jurisdiction and support AUSVETPLAN
- plans involving other areas of state and territory emergency management arrangements (eg police, local government)
- diagnostic resources
- training materials.

A series of individual AUSVETPLAN manuals cover all the elements of EAD preparedness and management; they are:

- **Summary Document.** This describes the components of AUSVETPLAN and outlines their functional relationships.

---

4 www.animalhealthaustralia.com.au/programs/emergency-animal-disease-preparedness/ausvetplan

5 www.animalhealthaustralia.com.au/programs/emergency-animal-disease-preparedness/nasops

- **Disease strategies.** These are authoritative references to the Australian control and eradication policies for most of the diseases listed in the EADRA. They provide information about the nature of the disease; the principles of its control and eradication; and control policies, strategies and recommendations. Sufficient information is included to allow authorities to make informed decisions about controlling an EAD outbreak.
- **Response policy briefs.** These provide brief information on the other EADs that are subject to cost sharing, but are not covered by full disease strategies because they have a low likelihood of entry into Australia, and any consequences are likely to be less severe.
- **Operational manuals.** These describe in detail the recommended procedures for different aspects of an EAD response, such as animal destruction and disposal, decontamination of infected sites, and communication management.
- **Management manuals.** These provide detailed information on specific components of the response. For example, the **Control Centres Management Manual (Parts 1 and 2)** provides details of the management structure, and roles and responsibilities at the national, state or territory, and local levels. The other management manual is the manual for **Laboratory Preparedness**.
- **Enterprise manuals.** These cover specific risk enterprises — such as abattoirs, artificial breeding centres, beef-cattle feedlots, piggeries, poultry enterprises and zoos — that pose special economic or disease eradication problems, have unusual operational practices or are important in the epidemiology or impact of the disease. They provide information and guidance to two target groups:
  - government personnel involved in EAD preparedness who may be unfamiliar with the operations of the industry of which the enterprise is part
  - industry personnel and veterinarians who need information on strategies that may be adopted to improve preparedness and guidance on the operational procedures that may be applied to exclude, contain or eradicate an EAD.
- **Wild Animal Response Strategy.** This sets out the management strategies and overall control procedures relating to wild animals during an EAD outbreak.

This complex web of plans is illustrated in Figure 1.1.

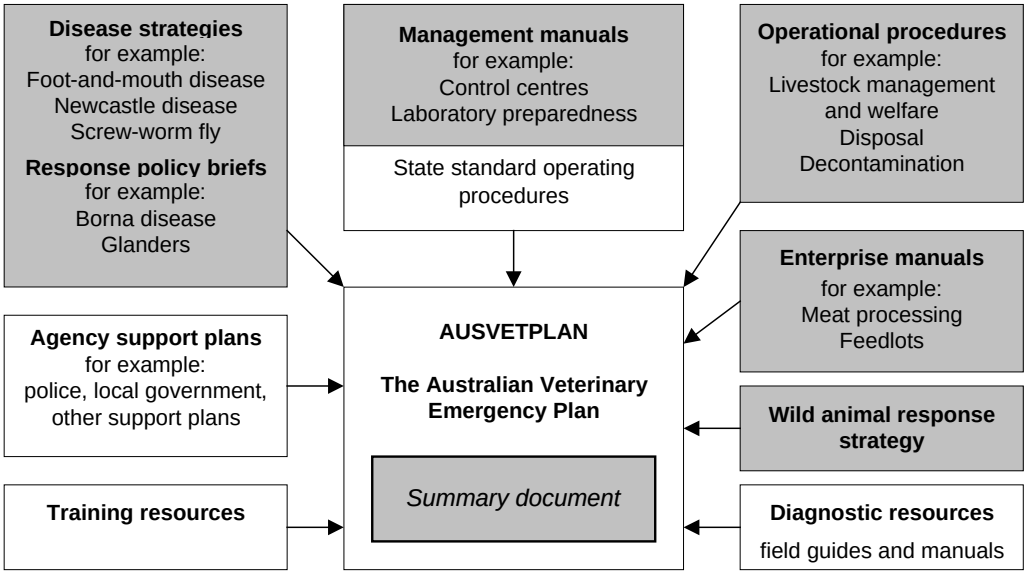


Figure 1.1 **Available AUSVETPLAN and other relevant manuals that cover all aspects of emergency animal diseases**

1.4.1 AUSVETPLAN manuals that apply to zoos

Because zoos hold a wide variety of species, almost all EADs (except bee diseases) are potential risks (see Appendix 1).

The main diseases relevant to the zoo industry are listed in Appendix 2.

1.5 National Zoo Biosecurity Manual

The *National Zoo Biosecurity Manual*[6] was developed as an industry resource to raise awareness of best practice in zoo biosecurity. The manual is intended to be used by individual zoos, including fauna parks, sanctuaries, noncommercial aquariums and marine parks, holding native and/or exotic species, as a tool to help them to gauge their own biosecurity requirements and to develop a biosecurity plan suitable for their particular circumstances.

1.6 Legislation

Legislation to control EADs has been enacted at both the national and state/territory levels. The national legislation is primarily concerned with preventing the introduction and establishment of disease, or the introduction of things that may carry disease. Statutory provisions in all states and territories aim to control and eradicate specified diseases in animals, and establish controls over animal movement, treatment, decontamination, slaughter and compensation. Wide powers are conferred on government inspectors, including the power to enter

[6] www.zooaquarium.org.au/wp-content/uploads/2011/10/National-Zoo-Biosecurity-Manual-March-2011.pdf

premises, order stock musters, test animals, and order the destruction of animals and products that are suspected of being infected or contaminated.

1.7 Controlling a major disease outbreak

Controlling 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 health, trade, environmental health and recovery issues.

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 (destruction of all infected and exposed animals), where this is applicable to the EAD in question and considered to be cost-effective. This may involve:

- quarantine of premises and/or movement controls
- valuation and compensation
- destruction and disposal of infected and exposed susceptible animals
- decontamination of infected premises
- surveillance of susceptible animals
- restriction of the activities of certain enterprises
- an industry and public awareness program.

Other measures that may be used where necessary include:

- vaccination
- vector or wild animal control
- treatment of affected animals
- use of sentinel animals.

In some circumstances, a modified stamping-out approach may be used, if it is possible to slaughter animals safely at an accredited abattoir to produce a marketable product.

Sometimes, eradication is not considered feasible because the incursion 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 EAD response plan will exceed an agreed limit on funding, the NMG may decide to stop cost sharing.

All disease control field activities have significant implications for zoos. Factors that need to be taken into account in developing an appropriate response include the protection of valuable breeding stock and business continuity. Disease control

activities are managed from a local control centre (LCC), usually established in the vicinity of the outbreak. The LCC is responsible for all activities within the restricted area, including investigations of reports of disease outbreaks, consultation with livestock producers, specimen collection, property quarantine, valuation of livestock and property, livestock slaughter and disposal, and property decontamination.

Information on the structure, roles and responsibilities of the state or territory control centre (SCC) and LCCs is contained in the **Control Centres Management Manual, Part 1**.

ILOs are trained and accredited to undertake prescribed AUSVETPLAN roles in both SCCs and LCCs. They are a point of contact for local producers and a source of advice to the LCC managers.

The response to an incursion of an exotic disease in a zoo will be determined by the circumstances of the incursion, including:

- how early the incursion is detected
- the extent of the incursion
- the location and location history of affected premises
- the range of species affected or at risk
- the characteristics of the disease agent involved
- the intrinsic and genetic value of the at-risk animals.

1.7.1 Movement restrictions

Animals

Controlling the movement of livestock that are susceptible to a disease is an essential component of livestock disease control. However, such regulatory controls can potentially affect zoo operations, especially when they are maintained for an extended period.

Feed, water and waste

Controlling the movement of feed, water and waste may also be essential to control the disease outbreak. Such controls may have an impact on zoo operations, particularly when they are maintained for an extended period.

People

By the nature of their core business, zoos have significant movements of people into and out of their premises. Closure of the zoo or limitation of people movements can severely impact on a zoo. Risk assessment and the imposition of movement restrictions on people must be considered carefully.

1.7.2 National livestock standstill

Following a diagnosis of a highly infectious EAD such as foot-and-mouth disease (FMD) or equine influenza (EI), or a strong suspicion of FMD or EI, a national livestock standstill will be imposed, leading to total movement controls on all FMD- and EI-susceptible species. The standstill will be triggered by the NMG, acting on the advice of the CCEAD, and will be implemented for at least 72 hours.

Easing, lifting or extending the standstill will be based on a risk assessment and the developing knowledge of the circumstances of the outbreak.

The national livestock standstill will apply only to FMD- and EI-susceptible animals. However, during the livestock standstill, jurisdictions may impose movement controls over other products (including meat, carcases and/or offal) and equipment.

Guidelines for managing animals that are in transit to an abattoir or other location at the time of the declaration will be provided by the disease response authorities. A national standstill on livestock movement potentially reduces the spread of a disease and provides time for animal health authorities to trace contacts, carry out surveillance to determine the outbreak size and develop a management plan.

Effect of a national livestock standstill on zoos

Zoo animals are not domesticated and have nonstandard requirements for housing, handling and care (see Section 2 and the *National Zoo Biosecurity Manual*). Specific animal management issues, including animal welfare concerns, apply when caring for zoo animals during transport. These issues can be managed by returning animals directly to their point of origin or directly transferring them to another institution where risks can be appropriately managed.

Because of the small numbers of zoo animals likely to be in transit at any time, the isolation of zoo animals from domestic stock and the strong biosecurity processes followed in zoos, it is very unlikely that the controlled movement of zoo animals during a livestock standstill would significantly increase the risk of disease spread during an EAD outbreak.

1.7.3 Declared areas

A national standstill is likely to be followed by the declaration of control areas (CAs) and restricted areas (RAs). These declared areas are geographic areas of land where the movement of livestock (and other materials) may be restricted for extended periods.

An RA is a relatively small legally declared area around infected premises (IPs) and dangerous contact premises (DCPs) that is subject to the most intense surveillance and movement controls. An initial RA of at least 'x' km radius[7] (often 3 km) will be drawn around all IPs and DCPs, including as many suspect premises (SPs), trace premises (TPs) and dangerous contact processing facilities (DCPFs) as practicable, and based on risk assessment. Movement of live animals out of the RA is usually prohibited, while movement within and into it would only occur after an official permit has been issued by a government veterinarian or gazetted inspector of stock. Guidelines for establishing an RA are provided in the relevant **Disease Strategy** for the EAD. Multiple RAs may exist within one CA.

[7] For specific details, refer to the relevant AUSVETPLAN **Disease Strategy** (www.animalhealthaustralia.com.au/programs/emergency-animal-disease-preparedness/ausvetplan).

A CA forms a buffer between an RA and areas considered to be free from disease (outside area — OA). Initially, a CA may be declared over the whole state or territory, but will usually be reduced in size as authorities learn more about the extent of the outbreak.

The CA will have a minimum radius of 'y' km[8] (usually no less than 10 km), encompassing the RA(s). It may be defined according to geography, climate and the distribution of feral animals. The boundary will be adjusted as confidence about the extent of the outbreak increases.

Live susceptible animals and their products will be subject to movement controls. In general, surveillance and movement controls will be less intense in the CA than in the RA, and disease-susceptible animals and their products may be permitted to move under permit within and from the area. Vehicles and specified products will only be allowed out of a CA into the OA by official permit. The actual movement conditions will depend on the disease and will be determined by the lead agency. Information on movement conditions will be provided through media outlets. Usually, permits will be made available for specific movements to continue where the risk is low.

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 OIE *Terrestrial Animal Health Code* standards on the disease (in the relevant disease chapter), and zoning and compartmentalisation (Chapter 4.3 of the OIE Terrestrial Code)[9] give guidance on specific activities. RAs and CAs are declared for the purposes of disease control, and zones may be used for trade and business continuity purposes. RAs and CAs declared for the purposes of disease control may not be the same as OIE zones for trade. For the latter, consideration will need to be given to the Terrestrial Code guidelines.

Figure 1.2 illustrates how controls over the movement of animals may affect access to declared areas; similar principles may apply to people and equipment.

---

8 For specific details, refer to the relevant AUSVETPLAN **Disease Strategy** (www.animalhealthaustralia.com.au/programs/emergency-animal-disease-preparedness/ausvetplan).

9 www.oie.int/international-standard-setting/terrestrial-code/access-online

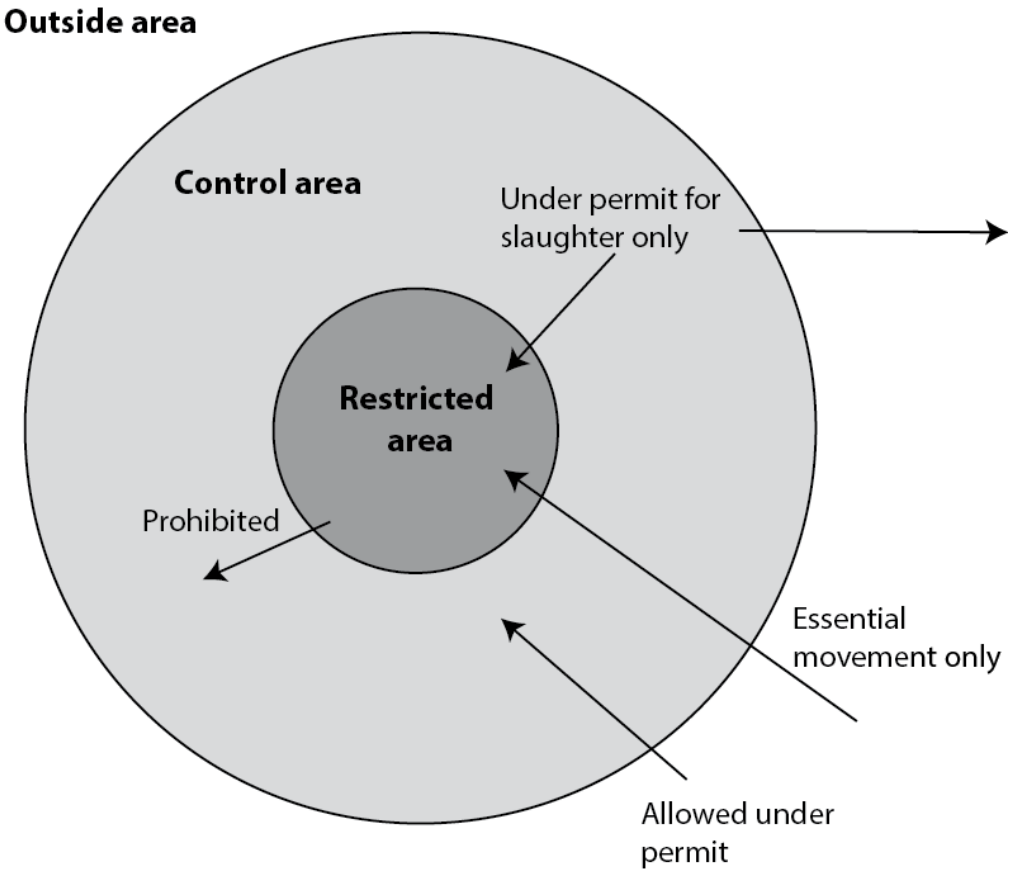


Figure 1.2 Schematic illustration of standard movement controls during an emergency animal disease outbreak

It is important to recognise that the designation of declared areas can change during an EAD response as authorities learn more about the nature and distribution of the disease. These changes create uncertainties that make forward planning for the resumption of livestock movements even more difficult.

Premises classifications in an EAD response are as follows:

- **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 EAD 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.
- **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 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.
- **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).
- **Trace premises (TP)**: Temporary classification of a premises that contains a 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).
- **At-risk premises (ARP)**: A premises in an RA that contains a live susceptible animal(s) but is not considered at the time of classification to be an IP, DCP, DCPF, SP or TP.
- **Premises of relevance (POR)**: A premises in a CA that contains a live susceptible animal(s) but is not considered at the time of classification to be an IP, DCP, DCPF, SP or TP.
- **Resolved premises (RP)**: An IP, DCP or DCPF that has completed the required control measures and is subject to the procedures and restrictions appropriate to the area in which it is located.
- **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.
- **Zero susceptible species premises (ZP)**: A premises that does not contain any susceptible animals or risk products, wastes or things.
- **Assessed negative (AN)**: A qualifier that may be applied to ARPs, PORs and premises previously defined as SPs, TPs, DCPs or DCPFs that have undergone an epidemiological and/or laboratory assessment and have been cleared of suspicion at the time of classification, and can progress to another status. The animals on such premises are subject to the procedures and movement restrictions appropriate to the declared area (RA or CA) in which the premises is located. This classification is a description to document progress in the response and in the proof-of-freedom phase. The AN qualifier is a temporary status and only valid at the time it is applied. The time that the AN qualifier remains active will depend on the circumstances and will be decided by the jurisdiction. One day is considered a reasonable guideline. The AN qualifier should also provide a trigger for future surveillance activity to regularly review, and change or confirm, a premises status.

Although these designations seem complex, it is important to understand that a property may fit into only one classification at any given time. In addition, not all of these classifications may be needed in a particular EAD response. Based on the disease risk, the highest priorities for investigation by the disease control authority are IPs, DCPs, SPs and TPs.

On an IP, SP, DCP or TP, quarantine and movement controls will apply. On an SP or TP, other disease control actions will follow only if the premises is reclassified as

an IP. On an IP, live animals may be destroyed as part of a stamping-out strategy, or other disease control actions may be compulsorily applied by the authorities.

Classification of properties according to the above criteria is an important part of EAD control and eradication. Any restrictions that apply to a classified property will be fully explained by the animal health authority at the time of classification.

Relevance of declared areas to zoos

Zoos may fall within an RA or a CA for an EAD occurring in domestic species outside the zoo. Depending on specific circumstances, zoos may fall into any of the premises classifications and would be subject to the activities relevant to their status. For example, during the 2007 outbreak of EI, open-range zoos with zoo equids were affected by the EAD response.

1.7.4 Zoning and compartmentalisation for international trade

The OIE sets international standards for the improvement of animal health and welfare, and veterinary public health worldwide, including standards for safe international trade in animals and their products.

According to the OIE *Terrestrial Animal Health Code*,[10] establishing and maintaining a disease-free status throughout the country should be the final goal for OIE Members. However, given the difficulty of establishing and maintaining a disease-free status for an entire territory, especially for diseases whose entry is difficult to control through measures at national boundaries, there may be benefits to a Member in establishing and maintaining a subpopulation with a distinct health status within its territory. Subpopulations may be separated by natural or artificial geographical barriers ('zoning') or, in certain situations, by applying appropriate management practices ('compartmentalisation'). In practice, spatial considerations and good management, including biosecurity plans, play important roles in the application of both concepts.

Compartmentalisation is based on biosecurity provisions of specific enterprises and is a joint industry–government undertaking. Zoning is based on geographic areas and is a government responsibility.

If desired, a zoning application would need to be prepared by the Australian Government in conjunction with the relevant jurisdiction(s). The recognition of zones must be negotiated bilaterally with trading partners and is not an overarching international agreement. Zoning will also require considerable resources that could otherwise be used to control an outbreak, and careful consideration will need to be given to prioritising these activities.

Agreements between trading partners will take time to develop, consider and finalise, as a result of the need to provide detailed information, costing and resourcing, and national frameworks to underpin 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. It is

[10] www.oie.int/international-standard-setting/terrestrial-code/access-online

not known how Australia's trading partners would react to a zoning proposal; some countries might not accept 'zone freedom'.

Eradication may be achieved before a decision on a free-zone application is reached.

Managing disease-free zones is a responsibility of veterinary authorities.

Application of compartmentalisation to zoos

The principles of compartmentalisation can be applied to major zoos, which apply these concepts in their management of different sections of the zoo. For example, compartmentalisation will apply for zoos that have different animal sections with clear operational divisions (separate services, staff and equipment) for management of animals, including domestic animals, educational animals, mobile zoo collections or collections with close visitor contact. These practices help to maintain separate biosecurity zones or compartments.

Zoos may define and manage different sections within the zoo as compartments before a disease outbreak (in 'peacetime') to mitigate the possible impact of both endemic and emergency disease, and to make disease control and business continuity easier.

Compartmentalisation can be effective only if it is part of a national EAD control strategy using surveillance and monitoring, stamping-out strategies, on-property biosecurity and protection of the compartment from the incursion of disease agents. If biosecurity practices are sufficiently rigorous, the entire zoo may be considered a compartment for the purposes of EAD management.

1.7.5 Issues specific to the zoo industry

Zoos typically hold rare and endangered species, often of high genetic value. In addition, individual zoo animals often have high intrinsic value (see Section 2, including Section 2.1.2, for more details). Zoo animals are not mass produced, and they do not enter the human or livestock food chain. In the event of an EAD, zoo managers will be reluctant to destroy susceptible zoo animals if other options for disease control exist; ultimately, this would be a CCEAD and NMG decision in consultation with the zoo industry.

Typically, large numbers of visitors move through a zoo every day. Visitor movement and access may need to be controlled during an EAD outbreak. Staff movement into, out of and within the zoo may also need to be controlled. However, it will be essential that key staff and feed supplies are able to enter the zoo, to maintain the care and nutrition of the animals.

Zoo veterinarians have a well-developed awareness of emergency and exotic animal diseases and the possible impact of these on the zoo industry. Unlike production animal industries, the zoo industry does not currently appoint ILOs. However, the peak body for Australasian zoos — the Zoo and Aquarium Association (ZAA) — employs a part-time regional veterinary officer, and members of the Zoo Animal Health Reference Group (see Section 2.2.2) have undertaken specific EAD and CCEAD training run by Animal Health Australia. In the event of an EAD outbreak, the regional veterinary officer would provide a point of liaison between the authorities, the ZAA and zoo veterinarians working for the affected zoo.

1.8 Training in emergency animal disease management

The National EAD Training Program,[11] managed by Animal Health Australia, provides training for livestock producers, veterinarians, other government personnel and representatives of the Australian livestock industries. The program's purpose is to prepare people for roles they may undertake in an EAD response. Each livestock industry ensures that there is a pool of skilled people trained to work as ILOs and industry liaison coordinators. It is a requirement of the EADRA that, where possible, jurisdictions use accredited, trained staff to combat an EAD.

[11] www.animalhealthaustralia.com.au/training-centre/emergency-animal-disease-training-program

2 Nature of the enterprise

2.1 Introduction

The Australian zoo industry is a small, close-knit industry with a well-established network, and has a strong, supportive culture of information exchange and shared decision making, particularly in response to emergency situations. It was one of the first industries with its own national biosecurity manual and has a very well coordinated approach to animal health management and preventive medicine. There is a high level of technical expertise within the zoo veterinarian community, with strong collegiate support. The industry and individual organisations have robust incident management systems, driven in part by high levels of visitation and management of dangerous animals in captivity. The industry is supported by its own regional veterinary officer and has a close working relationship with other animal health industries through Animal Health Australia and Wildlife Health Australia (previously the Australian Wildlife Health Network).

2.1.1 The purpose of zoos

The modern Australian zoo is a place where animals are held and exhibited to the public for the purposes of conservation, education, research and recreation. Zoos in Australia typically hold a variety of exotic and native species. They may work with conservation agencies and educators to provide an environment where rare and endangered species are bred and displayed for conservation purposes.

2.1.2 Unique considerations for zoos during an emergency animal disease outbreak

The majority of zoo animals (including most exotic species) are held and bred through tightly managed regional studbooks and cooperative breeding programs. The individual animals are often of high intrinsic and genetic value. Animals may have been acquired or imported at considerable effort, and may be difficult or impossible to replace. Some zoo animals are highly trained and/or socialised for particular purposes (eg birds of prey in free-flight bird shows), representing considerable input of resources. Management of zoo animals during an emergency animal disease (EAD) outbreak will require consideration of the value of these individuals, as well as animal welfare, social considerations and animal group dynamics. Management will also require awareness of the nondomesticated nature of zoo animals and the relative lack of knowledge of disease processes in these species, compared with domestic species. Tests and treatments for disease have often not been validated in many zoo species, and this must be taken into account when planning for inclusion of zoo species in response activities.

Zoos typically host large numbers of visiting members of the public, often including significant numbers of globally mobile international visitors. Zoos will need to be aware of the potential for close contact between staff or visitors and animals (eg through interactive animal programs), including the risk that international visitors may transmit diseases not present in Australia.

The risk of an EAD in zoo animals may arise through contact with humans, contact with free-ranging feral and native animals, contact with domestic animals, or introduction of or contact with an infected zoo animal. Every zoo, including those

housing only native species, is potentially at risk from all these avenues of contact. The role of nondomestic animal species, including zoo animals, free-ranging wildlife and feral animals, in the epidemiology of many EADs is not well understood.

In the event of an EAD outbreak, most of the major Australian zoos will have sufficient expertise and capacity to contribute strongly to any response. These major zoos constitute a relatively low risk for spread of an EAD. Minor and smaller enterprises may have less capacity to implement the necessary control measures, and may therefore represent a greater EAD risk. These organisations will be supported, where necessary, by expertise and resources from the Zoo and Aquarium Association (ZAA) and major zoos.

The value and irreplaceable nature of zoo animals creates a unique circumstance for zoos affected by, or at risk from, an EAD. There will be public interest and strong expectations around management of an EAD event in a zoo, which may have a significant impact on the process. Public expectations and media opinion are likely to play a significant role in decision-making processes.

Wherever possible, the principles and policies outlined in the relevant AUSVETPLAN manuals will apply. However, some consideration and flexibility will be needed in addressing the response to these valuable and endangered animals.

2.1.3 Sources of zoo animals

Most individual animals in zoos are bred in captivity in Australia. Animals may be moved between Australian institutions to manage numbers and genetic diversity. Some wild-born native species are brought into zoo collections as part of captive-breeding programs.

A small number of individual exotic animals are imported from overseas, primarily to improve genetic diversity in captive populations or for participation in global programs for endangered species management. All zoo animals imported into Australia have met the health conditions imposed by Australia's biosecurity authorities. The majority of these imported animals are bred in captivity in overseas zoos, which have well-developed preventive medicine and disease screening programs. Rarely, animals born in the wild in their country of origin are imported into Australia (see Section 2.8.1).

2.1.4 Zoo operations

Operations in Australian zoos vary widely in terms of geographic location, species and numbers of animals held, work practices and available resources. These differing circumstances will affect the inherent EAD risk, risk assessment processes, and the approach taken in the event of an EAD outbreak. More than 2000 vertebrate species are held in Australian zoos.

Zoos use risk assessment procedures and appropriate risk management strategies to minimise biosecurity risks. The *National Zoo Biosecurity Manual* (Reiss and Woods 2011) has been produced to provide guidelines for all zoos in biosecurity risk management.

Zoo animals are rarely housed in large herds or flocks, unlike domestic animals. Standard procedure is for zoo animals to be housed in small groups or individually. This allows individual animals to be closely monitored every day.

Zoo staff have appropriate expertise, and operate within a well-organised management framework and chain of command. Animal staff have a high level of technical expertise in the welfare, observation and physical handling of the species in their care (see Section 2.5).

Many zoos employ veterinarians and/or veterinary nurses with expertise in wildlife and exotic zoo animals. Some zoos without a staff veterinarian engage a local veterinary service, on a contract basis, to implement their preventive health program and respond on a case-by-case basis to health concerns in their animals.

Most Australian zoos have well-developed preventive medicine programs, with well-maintained written health and husbandry records for each animal. Disease risk management strategies include regular animal observations by trained husbandry staff; quarantine, disease screening and vaccination, as appropriate for the species and circumstances; timely and appropriate veterinary investigation and care of sick animals; and appropriate postmortem investigation of animals.

Many zoos also have well-documented incident management plans, supported by staff training programs in incident management. These plans will address animal disease contingencies.

Most zoos are increasingly offering interactive animal programs with some of their collection species, both on-site and off-site. Visitors are able to approach animals at close range and, in some cases, have supervised direct contact with the animals.

2.2 Industry management

2.2.1 Peak industry bodies

The ZAA, previously called the Australasian Regional Association of Zoological Parks and Aquaria, is the peak body representing the zoo, aquarium and fauna park industry in Australia and New Zealand. Membership of the association is voluntary; in 2012, there were around 60 Australian institutional members. The ZAA is governed by a board, which is elected from institutional and individual members. It has a minimum set of criteria for membership and accreditation, based on animal management, biosecurity awareness and welfare practices. The ZAA offices are hosted within Taronga Zoo in Mosman, New South Wales. Staff of the ZAA include a part-time regional veterinary officer, whose responsibilities include zoo industry liaison on biosecurity with government and regulatory agencies, and development of import health processes for zoo animals imported into Australia.

The New South Wales Fauna and Marine Parks Association (FMPA) is a representative group that works to enhance and develop fauna and marine parks in New South Wales. Many smaller enterprises that are not members of the ZAA are members of the FMPA, which has approximately 30 members. Some zoos are members of both the ZAA and the FMPA. Several other small industry bodies exist.

2.2.2 Industry liaison and technical groups

The Zoo Animal Health Reference Group (ZAHRG) is a group of senior zoo veterinarians brought together at the request of the Australian Chief Veterinary Officer (ACVO) to act as a focus point on issues that affect both government and the zoo industry. Emergency disease preparedness is one of the main foci of the ZAHRG. The group reports to the Australian Government Department of Agriculture and the Animal Health Committee through the ACVO's representative on the ZAHRG. The zoo veterinarians on the ZAHRG speak on behalf of their zoo directors. The group meets regularly throughout the year.

The ZAA convenes a number of specialist advisory groups (SAGs) to harness the collective resources of member zoos. The Veterinary SAG (approximately 70 Australian members) provides guidelines or policy on regionally relevant issues relating to zoo animal health, welfare and biosecurity, and shares information and professional expertise.

Wildlife Health Australia is a network of government and private stakeholders across Australia whose mission is to promote and facilitate collaborative links in the investigation and management of wildlife health. The network collaborates closely with the ZAA in areas of zoo biosecurity and emergency disease preparedness.

The Australian Registry of Wildlife Health operates within Taronga Zoo as a diagnostic and resource centre for zoo and wildlife pathology. The registry focuses on detecting and diagnosing endemic, emerging and exotic diseases of wildlife that could have impacts on Australia's trade, economy, biodiversity, tourism or human health.

2.2.3 Licensing and regulation

The zoo industry in Australia is highly regulated. Australian zoos are subject to international, Commonwealth, and state and territory legislation. Zoos are licensed to operate by their state or territory regulatory authorities, under Acts relating to zoos, wildlife, animal welfare and agricultural protection. The regulatory body may vary in different jurisdictions, depending on whether the zoo holds only native species or a mix of exotic and native species (see Appendix 3).

Some legislation applicable to zoos is listed in Appendix 4.

2.2.4 Industry guidelines

A range of industry guidelines provide additional advice relevant to EAD preparedness and response. These include:

- *National Zoo Biosecurity Manual* (Reiss and Woods 2011)
- *Guidelines for the Import, Movement and Keeping of Non-indigenous Vertebrates in Australia* (Vertebrate Pests Committee 2014)
- ZAA membership, and accreditation policies and procedures[12]
- ZAA code of ethics, code of practice, policies and guidelines

[12] www.zooaquarium.org.au/index.php/press-releases/policies

- zoo animal taxon-specific animal husbandry manuals.[13]

2.3 Types of zoos in Australia

Zoos may be operated as not-for-profit organisations under a state or territory government agency, or privately owned and operated. They may hold a mix of exotic, domestic and native species, or only native species.

Zoos in Australia can be broadly classified as either major or minor zoos, based on factors that influence their operational capacity. The geographic location of the zoo and its proximity to major habitation will also influence its operations. Major and minor zoos can be further classified as urban (metropolitan) or rural (open range).

Urban or metropolitan zoos typically:

- house animals in relatively close proximity, with small buffer zones
- have waste disposal systems based on removal of waste from the property.

Rural or open-range zoos:

- may be surrounded by agricultural areas holding domestic livestock
- may have higher levels of free-range native animals
- typically have waste disposal systems that include on-property management.

All zoo waste disposal systems operate to comply with relevant state or territory regulations.

The main characteristics of major, minor, metropolitan and open-range zoos, including their typical biosecurity arrangements, are summarised below.

2.3.1 Major zoos

Major zoos are well resourced and operate with a high level of professionalism and appropriate risk awareness. Although classification is not based solely on collection size or acreage, major zoos generally have large, diverse collections with a mix of exotic and native species. Most major zoos are metropolitan in location and mode of operation.

Many major zoos are administered by a state or territory government agency; some are either privately owned or operated by zoological societies. Most major zoos have a well-developed corporate hierarchy with an overarching board of directors.

Major zoos within Australia include Adelaide Zoo, Australia Zoo, Healesville Sanctuary, Melbourne Zoo, Monarto Zoo, Perth Zoo, Sea World, Taronga Zoo and Werribee Open Range Zoo. Major zoos typically have:

- large collections of both exotic and native animals
- animal collections that are intensively managed on a daily basis
- facilities with on-display ('exhibit') and off-display ('night yards') areas

[13] www.aszk.org.au/husbandry.husbandry.ews

- relatively high staffing levels, with significant support structures in place, including staff with specialised expertise
- large numbers of both local and international visitors
- purpose-built veterinary and quarantine facilities.

2.3.2 Minor zoos

Minor zoos are often owned and operated privately or by local councils or charitable trusts. Some minor Australian zoos are not members of the ZAA. Minor zoos may have limited resources, affecting their capacity to provide preventive medicine and routine health screening. They may also have fewer staff training and awareness programs for EAD preparedness, and less well-developed record-keeping systems, business continuity plans and emergency response plans.

Minor zoos typically:

- have smaller collections and fewer species
- have a small number of staff and less staff expertise
- may not employ a staff veterinarian, although most will have a contracted service from a local veterinarian
- have low to variable visitor numbers.

2.3.3 Open-range zoos

Open-range zoos typically have large acreage and extensive exhibits housing large mammal species, with an emphasis on large herbivores. They may be either major or minor zoos (based on the criteria outlined above) and are often located in rural areas or on the outskirts of large cities. They may be linked with a major urban zoo with which they share operating systems and support.

In open-range zoos:

- animals in extensive exhibits may be held in larger groups with lower densities than in metropolitan zoos
- animals are often held in enclosures containing more than one species (mixed-species exhibits)
- larger spaces or 'buffer zones' may occur between enclosures
- because of larger herd sizes and enclosure sizes, daily management of some species, notably large herbivores, is typically less intensive than in metropolitan zoos
- visitors numbers may be lower, and there may be greater physical separation between visitors and animals
- vehicles may routinely move through enclosures where animals are held.

Open-range zoos may have purpose-built facilities for quarantine of large zoo species, particularly hoof stock.

2.4 Management of staff and visitors

Staff within most zoos have well-defined roles and responsibilities and work under a robust hierarchy of management and reporting. They receive training specific to

the areas where they work. Zoos have documented standard operating procedures (SOPs), particularly for work practices involving animals and biosecurity. If necessary during an emergency, staff can be contacted out of hours and can be traced.

Zoo management and staff are aware of zoo-specific zoonotic disease risks (both for staff and visitors). Zoos have documented zoonotic disease risk management programs, including general personal hygiene, hygienic work practices and managing general biosecurity risks associated with zoos. Most zoos have structured zoonotic management programs for animal staff, which may include regular disease screening and vaccination (eg rabies vaccination, tuberculosis screening, tetanus vaccination).

Zoos also have post-handling hygiene procedures for visitors, including children, who are in contact with, or in close proximity to, animals in the zoo. In most cases, visitors have minimal contact with zoo animals, but, increasingly, zoos offer opportunities for the visiting public to have 'close encounters' with certain animals under controlled conditions. In major zoos with structured animal encounter programs, procedures are in place to reduce the risk of transmission of disease from people to animals. There may also be the capacity to trace visitors who have had close encounters with zoo animals.

Many zoos have significant numbers of volunteers, including school and university work-experience students, on-site on a daily basis. These volunteers receive appropriate induction and are supervised in their activities.

Others who have access to the zoo include external contractors, such as people constructing or maintaining facilities and equipment. In most cases, these contractors are not allowed near the animals. They receive induction training relevant to the areas of the zoo that they are allowed to access.

Zoos typically keep records of volunteers and contractors who access the zoo, and these individuals can be traced, if necessary.

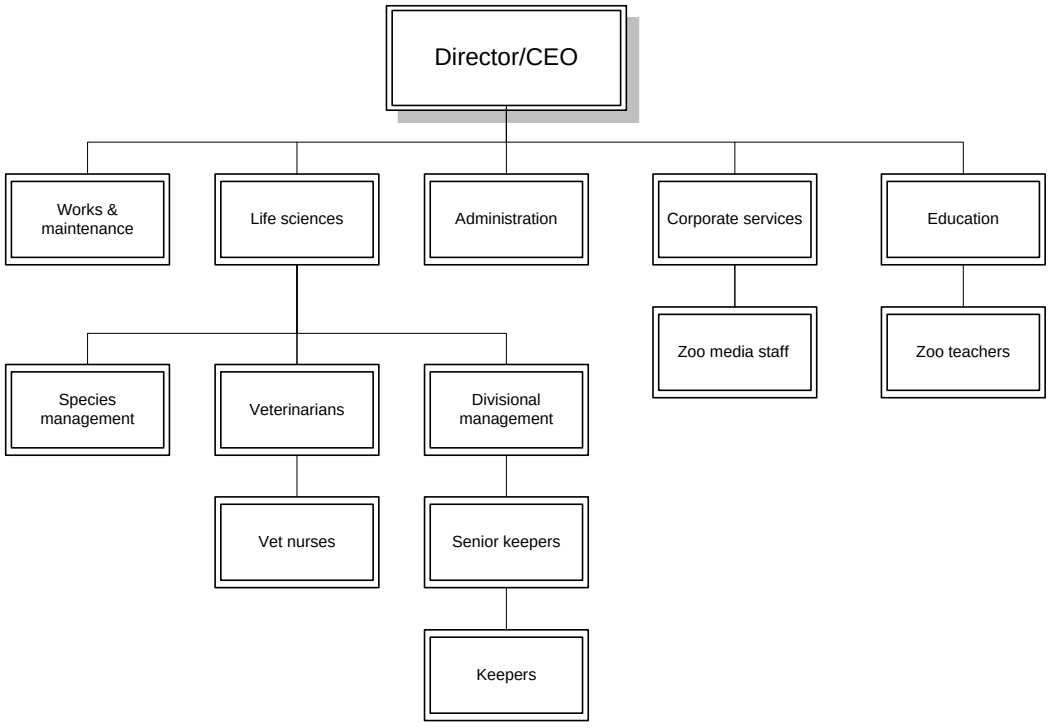
2.4.1 Staff structure and communication

Zoo staff typically operate in well-defined roles under a strong chain of command. In major zoos and many minor zoos, internal communication pathways are clearly identified and robust. Table 2.1 describes typical zoo positions, their regular reporting structure and responsibilities, and their role during an EAD outbreak. Figure 2.1 depicts the organisational structure of a typical zoo.

Table 2.1 Typical zoo roles and reporting structure

Position	Reports to	Routine responsibilities	Role during an EAD outbreak
Zoo director or CEO	Board or owner	Business decisions in the zoo	Holds primary and overarching responsibility for the zoo's response
Curator or life sciences manager	Director or CEO	Management of animal collections and animal staff	Provides detailed information on animal collection, movements, history, etc; assists with logistical decisions and operations
Keeper	Curator, life sciences manager or divisional manager	Day-to-day management and observation of animals	Carries out biosecurity and other operations, as directed
Zoo veterinarian	Life sciences manager (generally)	Routine health care and preventive medicine program; safe chemical restraint of animals	Closely monitors for disease; liaises with director and EAD response agencies to develop site-specific biosecurity plan; supports response team in safe and appropriate restraint of zoo animals

CEO = chief executive officer; EAD = emergency animal disease



CEO = chief executive officer

Figure 2.1 Typical zoo organisational structure

2.4.2 Media communication and public relations

The zoo industry in Australia has a relatively high public profile, with intense and often emotional interest from the community, particularly focused on endangered species and young or charismatic individual animals. Public perceptions and responses to zoos in Australia are generally very positive; however, zoos are subject to close scrutiny, particularly in the area of animal welfare. Major zoos and most minor zoos have well-established external strategies for communicating with the media, and directly to the public through social media outlets.

Major zoos generally employ a dedicated media and communications officer or team, whose responsibilities include promoting the zoo's profile with the media and managing media enquiries.

The AUSVETPLAN **Public Relations** operational manual contains additional information that may be useful for zoos during an EAD outbreak.

2.5 Collection management and animal husbandry

Animal management in zoos is significantly different from animal management in production animal industries. Zoo animal management emphasises holding and displaying small numbers of animals in naturalistic environments, with a view to encouraging natural animal behaviours and providing pleasing visitor aesthetics, while prioritising welfare and quality of life for individual animals and groups of animals.

2.5.1 Zoo husbandry and animal health care staff

Zoos employ trained animal husbandry staff with specific skills in the husbandry of nondomestic animals. These staff (generally known as keepers) operate within a hierarchy of experience and responsibility. They have a high level of technical expertise in the welfare, observation and physical handling of the various species in their care. Many have undergone formal tertiary education, including Certificate III and IV in Zoo Keeping.

Major zoos typically employ one or several veterinarians dedicated to the institution, with expertise in wildlife and exotic zoo animals, to provide veterinary service 7 days a week. Most veterinarians working full time as zoo employees only work with zoo animals and do not examine or treat domestic animals outside the zoo. Minor zoos may employ a local veterinarian part time or engage a local veterinary service, on a contract basis, to implement their preventive health program and respond on a case-by-case basis to collection animal health concerns. Trained veterinary nurses are employed by many zoos, and may provide valuable on-site veterinary support services in minor zoos without the full-time presence of a veterinarian. Most veterinarians employed in zoos have postgraduate training and qualifications in zoo and wildlife medicine.

2.5.2 Standard husbandry practices, observation and continuity of care

Zoo operations place a strong emphasis on routine observation of all animals in the collection; keepers observe most collection animals frequently throughout the working day, particularly when animals are moved from off-display to display areas, and closely monitor their animals for signs of disease or ill-health. Extensively managed groups of animals are deliberately observed for signs of health and disease at least once per day. Keeper observations are recorded on a

daily basis, and are communicated to animal managers and veterinary services (see Section 2.5.7). Keepers have training in, and expert knowledge of, behaviour and signs of health and disease in the species and individuals with which they work. Because of the small numbers of individual animals, the personal characteristics and behaviour of each animal will be well known to keepers, and changes in behaviour and appearance, possibly indicating disease, will be easily recognised.

2.5.3 Restraint of animals

Many zoo animals cannot be restrained or handled in the same ways as domestic animals. Some species are large and/or potentially dangerous, and many species can suffer potentially lethal levels of psychological and physical stress if inappropriately restrained. Zookeepers and veterinary staff have expertise in appropriate handling methods for the species in their care, and zoos have facilities and equipment for appropriate manual handling. Depending on the species, restraint may involve physical restraint, chemical restraint or a combination of both. Remote delivery of chemical agents ('darting') is often required in larger zoo animals, in both urban and open-range zoos. Physical restraint methods commonly used in zoos include nets, traps and purpose-built 'restraint devices' or 'crushes'. Zoos increasingly use behavioural conditioning programs to allow close inspection and minor intervention with some zoos species. Nevertheless, for some zoo species, close observation, restraint, examination and sampling are challenging. For many zoo species, full physical examination and health assessment can only occur under general anaesthesia.

2.5.4 Design of animal housing and enclosures

A wide variety of animal exhibits and holding facilities are used in zoos. Typical zoo animal enclosures have an exhibit area for animal display with adjacent off-display or night quarters. Display areas are carefully designed for purpose and are often complex, with significant vegetation or furnishings, and a focus on creating naturalistic behaviours and environments that provide good animal visibility for visitors. These areas are often more open and may be less easily cleaned than off-display areas, which tend to be smaller, with simple, easily disinfected surfaces. There may be purpose-built animal restraint facilities associated with the off-display enclosures. Housing animals in off-display areas for long periods may have negative welfare and management implications, and may not be allowed under relevant regulations.

Zoos manage all aspects of animal holding areas, including movement of people in and out of the area; movement of animals within, into and out of the area; and movement of items (including food, tools, furnishings and waste) into and out of the area.

Animal exhibits and off-display holding areas are generally cleaned daily, following documented SOPs. More extensive exhibits, including open-range exhibits, may be cleaned on a less frequent basis; however, they will be cleaned regularly, as dictated by the SOP.

Zoo animal enclosures, including exhibit areas, are costly to build. They require significant investment in design, development, construction, infrastructure and maintenance. Details on appropriate zoo animal enclosure design, management and maintenance can be found in the *National Zoo Biosecurity Manual* (Reiss and Woods 2011).

2.5.5 Routine security for zoo property and enclosures

Zoos routinely maintain a high level of physical security, both within the perimeter of the zoo property, and surrounding and within animal enclosures. Most zoos are surrounded by a high fence or wall to discourage unauthorised human access. Access gates are supervised during operating hours and locked at other times. Access gates to animal enclosures are locked, with key access restricted to relevant trained staff. Enclosures are constructed and maintained to minimise both unplanned animal escape and deliberate theft of animals. Appropriate security precautions are taken when animals are transported within the property or between zoos. Zoos are required to comply with regulations regarding secure holding of nondomestic species. They have protocols for emergency response to unplanned animal escape, which include emergency drills and emergency equipment.

2.5.6 Animal identification

Most zoos permanently identify all collection animals. Where possible, this is by microchip; less commonly, tattoos or other visual methods are used. Ear tags may be used on mammals, and leg bands or flipper tags on birds and chelonians (eg turtles).

2.5.7 Zoo animal record keeping and traceability

Most zoos maintain detailed written records for all collection animals, including information on animal health, husbandry and movements. These records are reviewed, usually daily, by animal managers and veterinarians. Major zoos will have an animal records officer, who is responsible for collating and distributing animal records.

Most Australian zoos use the electronic Zoo Information Management System (ZIMS) developed by the International Species Information System (ISIS). Under this system, each individual animal within the zoo's collection has a unique identification number ('accession number') and associated electronic data file. Through this system, the animal and all its records are fully traceable. Veterinary records are maintained electronically via the MedARKS database, hosted by ISIS, other purpose-built zoo software products, paper records, or a combination of all three. A new module of ZIMS encompassing veterinary records and streamlining management of veterinary records was released in mid-2014; Australian zoos will gradually adopt this system over the next few years.

The ISIS data systems allow individual zoo animals and their offspring to be easily traced. The following data can be retrieved at short notice:

- an inventory report for each institution that provides data on animal status according to births, acquisitions, deaths and translocations
- a taxon report that lists all the specimens of a given taxonomic group held by the institution, and their identification, parentage, date of birth, location and origin
- an individual specimen report that includes full details of the individual animal's history, observations, care, treatment and movements, both within the institution and from one institution to another
- transaction reports that detail all animal movements for any given period

- enclosure reports (with historical option) that show the location of an animal and any animals that have shared their enclosure.

2.5.8 Regional zoo species management programs

Zoos in Australia hold a wide variety of nondomestic animal species — more than 280 mammal species, 500 bird species, and 330 species of reptiles and amphibians. Many of these species are listed as endangered or threatened. Australian zoos manage 111 of these species on a cooperative regional level ('managed species'), through the Australasian Species Management Program (ASMP; see below). The threatened species listing of zoo animals will need to be taken into account when managing an EAD outbreak at a zoo.

Australasian Species Management Program

The ASMP facilitates recommendations on species management for all ZAA member institutions in the region. The ASMP's annual regional census and plan contains information on the species and the number of specimens held by each member zoo, and a directory of all participating zoos and their key personnel (director, records manager, veterinarian, etc). An annual ASMP executive report provides a summary of the program, and its activities and achievements.

[Database of animals born overseas

The ZAA is developing an annually updated electronic database of all mammals, birds and reptiles born overseas and now held in ZAA collections. Information includes date and place of birth, and dates and locations of each place of residence within Australia. The database is expected to be operational by the last quarter of 2013.]

2.6 Management of zoo animal health

The small number of individual animals in zoos and zoo work practices mean that the personal characteristics and behaviour of most animals are well known to keepers. Changes in behaviour and appearance, which could be signs of disease, will be easily recognised. Guidelines on zoo procedures relating to animal health are available in the *National Zoo Biosecurity Manual* (Reiss and Woods 2011). Most zoos have on-site purpose-built veterinary facilities, including a postmortem room and a basic clinical pathology suite.

2.6.1 Preventive medicine

Most zoos, and all major zoos, have well-developed and documented preventive medicine programs, which include routine health checks of individual animals, quarantine, disease screening, vaccination programs, routine screening for and management of internal parasites, nutrition and necropsy. For many zoo species, full physical examination, health assessment and diagnostic sample collection can only be performed safely under general anaesthesia. For this reason, it is standard practice for zoo veterinarians to opportunistically perform a thorough health assessment, including relevant sample collection, whenever large or dangerous zoo animals are anaesthetised. Many individual animals will have comprehensive written medical records, including sequential haematology and serum biochemistry profiles, and baseline values for serological disease testing. Reproduction of most zoo animals is tightly controlled, and surgical or chemical methods of contraception are often applied.

2.6.2 Serum banks

Many major zoos have stores of inventoried, banked serum from collection animals maintained in ultracold freezers on-site or in collaborating institutions. Many zoos also store preserved tissue samples. These resources may be used to assist in pre- and post-exposure, or pre- and post-vaccination, epidemiological studies of zoo animal species during an EAD outbreak.

2.6.3 Quarantine practices

All zoos that import animals from overseas are required by law to meet post-arrival quarantine import requirements, as described in the relevant import conditions (see Section 2.8.1).

In addition, most zoos in Australia voluntarily apply institutional quarantine practices to animals newly arrived from within Australia, whether they are arriving from another zoo or from the wild. These quarantine processes are specific to the species, circumstances and associated risks. Guidelines on general zoo quarantine practices can be found in the *National Zoo Biosecurity Manual* (Reiss and Woods 2011). Generally, an animal is isolated for 30 days, during which it will be subjected to a full clinical examination under general anaesthesia, screened for diseases of concern (including endoparasites) and treated, if necessary (including vaccination, if appropriate).

Wildlife cases undergoing treatment or rehabilitation at zoo-based wildlife clinics are physically separated from collection animals and/or functionally isolated through standard practices of barrier nursing and keeping. If the eventual fate of these animals is to remain at the zoo, they will undergo quarantine procedures before entering the collection.

2.6.4 Management of sick animals

The standard animal husbandry, observation, recording and reporting processes practised in zoos facilitate timely identification of compromised and potentially sick animals. High levels of keeper awareness about biosecurity issues relevant to zoos, along with zoo-specific training, contribute to the likelihood of early detection of an EAD.

In additional to a high level of preventive medicine and scrutiny of zoo animals, the value placed on individual zoo animals ensures that priority is placed on maintenance of good health, and prompt investigation and treatment of signs of ill-health. Trained, experienced zoo veterinarians with appropriate awareness of EADs are employed in many Australian zoos. Most zoos have allocated budgets to support preventive medicine programs, and appropriate diagnosis and treatment of disease and ill-health in collection animals. Many zoos receive in-kind diagnostic support from state or territory animal diagnostic laboratories.

When appropriate, zoo animals in ill-health are isolated from other zoo animals until a diagnosis is confirmed and/or treatment has managed the risk of infectious disease. Established biosecurity practices to manage sick animals include barrier nursing, disinfection and decontamination of equipment, and appropriate movement controls within the zoo. Concurrent health screening of other at-risk animals is conducted, as necessary. The practices of zoos allow for compartmentalisation, if necessary (see Section 1.7.4).

In major zoos, and some minor zoos, veterinarians and keepers monitor the general health of wild animals residing in and around the zoo property. Staff are alert to the possible risks associated with a change in health or death of feral and other free-ranging species in the zoo grounds.

2.6.5 Australia's zoo-based surveillance system

Several of Australia's major zoos contribute to Australia's general wildlife health surveillance system through the Zoo Based Wildlife Disease Surveillance Program, administered by Wildlife Health Australia. Participating staff are trained in appropriate reporting pathways and remain alert to potential disease (including EAD risks) and its implications. It is estimated that the 10 major zoos currently participating in the program examine more than 18 000 wildlife cases annually.

2.6.6 Collection animal deaths, postmortem examination and carcass disposal

It is standard practice for zoos to investigate the deaths of collection animals through a full postmortem examination conducted by the zoo's veterinary service, followed, as necessary, by histopathological and other diagnostic testing. The zoo's veterinary service or animal manager may make a risk-based assessment of the intensity of investigation required. Noncollection animals (wildlife rehabilitation cases) may also receive a full postmortem investigation.

Zoos have standard procedures for retrieving, storing and disposing of zoo animal carcasses, and for postmortem reporting and investigation. These include appropriate use of personal and environmental protection and decontamination.

Deaths of any zoo collection animals under the Australian Government Department of Agriculture import conditions, such as post-arrival or lifetime quarantine, must be reported to the department.

2.7 Management of pests, stray and feral animals, and free-ranging wildlife within zoos

Zoos develop SOPs to manage vertebrate and invertebrate pest risks on their properties. Each zoo's pest management program will depend on its environment, the species in the collection and a risk assessment. Pest management typically includes perimeter fencing to minimise incursion by terrestrial vertebrate pests, and ongoing, structured rodent control programs. Zoos also consider invertebrate pest control and implement risk-based control programs, as appropriate. However, free-ranging arboreal mammals and birds may be more difficult to manage; the focus of management programs for these animals is generally based on a risk assessment.

2.8 Sourcing zoo animals

The vast majority of animals in Australian zoos are:

- born within a zoo, or
- born in the wild, or
- born in another managed facility such as the domestic pet industry, a commercial farm or an avicultural premises.

The majority of Australian zoo animals, both native and exotic, are born in Australia in registered zoos. Animals are regularly transferred between Australian zoos, to meet studbook requirements and to balance animal numbers to holding capacity.

Some animals within the zoo (most commonly native species) are born in the wild (see Section 2.8.2). They usually enter the zoo collection either as a result of wildlife rehabilitation efforts, or through specific species acquisition programs. All these animals will complete institution-specific and species-specific quarantine processes before they enter the zoo collection.

Occasionally, zoos acquire exotic or native species from university or research animal houses or other specialist facilities in Australia. Domestic animals that form part of the zoo collection may be sourced from farms, breeders or private individuals.

Although the majority of exotic zoo animals are born in Australian registered zoos, occasional importations of exotic animals from overseas are strategically planned to supplement genetic stock in Australia. All importations are subject to strict regulation (see Section 2.8.1).

2.8.1 Importation of zoo animals

Importation of zoo animals from overseas is highly regulated. Because of the very low numbers of individual zoo animals imported into Australia, the lack of contact between zoo animals and domestic animals, and the high level of biosecurity and active disease screening practised before, during and after shipment, the likelihood of an EAD agent entering Australia as a result of legal importation of a zoo animal is very remote. Zoo animals are not moved through saleyards or other areas where large groups of animals are brought together.

The Australian Government Department of Agriculture develops and manages assessment policies for the importation of zoo species into Australia. Importation of each taxonomic group is subject to strict controls based on scientific risk analyses, in accordance with Australia's risk-based approach to biosecurity.

Most animals imported into Australian zoos were born in overseas zoos, often with many generations of zoo residency behind them. Imported zoo animals undergo strict pre-export quarantine and post-arrival quarantine in quarantine-approved premises (QAP).

Any zoo in Australia may apply for, and receive, QAP status if it meets and maintains the criteria set by the Department of Agriculture (under QAP Criteria Class 7.9 for live zoo animals).[14] Key zoo staff must also have current QAP accreditation. Major zoos sometimes provide QAP facilities and expertise to allow smaller institutions to import animals, although development of the QAP criteria for live zoo animals has reduced the need for this. In some cases, imported zoo animals are placed in extended or lifetime quarantine or quarantine surveillance.

[14] www.daff.gov.au/biosecurity/import/general-info/qap/class7

Once imported zoo animals have completed their stipulated post-arrival quarantine, they may be moved from one zoo to another within Australia. It would be very unusual for these animals to be moved outside the zoo industry. On the rare occasions that exotic zoo animals are released from zoos to private individuals, they are subject to state and territory regulations surrounding authority to hold nonindigenous animals.

2.8.2 Other animals entering zoo collections that may pose a specific disease risk

Confiscated animals, including animals illegally imported into Australia

Nondomestic live animals (and reptile and avian eggs) are occasionally confiscated by regulatory authorities at Australia's borders, following illegal attempts to smuggle animals into or out of Australia. State or territory authorities may also confiscate illegally held nondomestic animals within their jurisdiction. At present, Australian zoos are commonly asked to hold these confiscated animals, under quarantine, while their long-term future is determined by the authorities, pending the outcome of evidentiary investigations. These confiscated animals are of unknown disease status, and unknown provenance and history, and pose a particular biosecurity risk to zoo animals and sometimes to zoo staff. Zoos are aware of these risks and, as far as possible, implement actions to limit and manage them. Under some circumstances, however, such risks are not able to be fully mitigated.

Zoos are asked to house confiscated animals because there is no suitable alternative accommodation. There are strong expectations that zoos fulfil their community service obligations by caring for these animals. The processes involved are generally not formalised or well regulated, and have evolved in response to needs outside the zoo industry. Zoo veterinarians may be requested to perform disease risk assessments for these seizures as a result of limited capacity in other agencies.

The eventual fate of confiscated animals is usually determined by the regulatory authorities and the judicial system; they may be released to defendants, undergo quarantine and enter the zoo collection, undergo quarantine and be passed to private individuals, or be euthanased.

Wild-born native Australian species: noncollection and wildlife rehabilitation animals

Zoos may treat and temporarily hold free-ranging wildlife species in wildlife rehabilitation facilities associated with the zoo. These orphaned, injured or sick animals are brought to the wildlife clinics by members of the public, including volunteer wildlife rehabilitators and wildlife officers. They are held and managed in ways that minimise recognised biosecurity risks to zoo collection animals. The *National Zoo Biosecurity Manual* (Reiss and Woods 2011) details standard practices for zoos to manage these risks. Feral animals presented to zoo wildlife clinics are euthanased or sent to another animal hospital (eg an RSPCA veterinary clinic).

Most zoos that accept wildlife admissions have dedicated treatment and rehabilitation facilities, staff and equipment.

Because of the nature of wildlife injury and disease, a high percentage of such cases are euthanased or die during treatment. The majority of surviving animals

are released back into the wild or returned to wildlife rehabilitators for care before release. Occasionally, animals are not suitable for release and may be held for the remainder of their life in a captive environment. Some may enter the zoo collection, after undergoing appropriate quarantine. Others may be sent to other institutions, including museums, or to private enterprise (such as private herpetologists or aviculturists). Rarely, such animals are transferred to zoos overseas. In all cases, appropriate permit requirements and regulations are followed.

2.9 Movements of animals on-site and off-site

2.9.1 Collection animals leaving zoos

Collection animals (exotic or native species) leaving zoos are most commonly sent to other zoos in Australia. Other destinations include:

- purposeful, sanctioned release into the wild
- transfer to another zoo overseas, often as a part of a managed species program
- rarely, transfer to a non-zoo enterprise (including circuses, universities and farms) or private individual within Australia.

Rarely, zoo animals surplus to collection requirements may be euthanased or culled (euthanased for management rather than health reasons). Feeding of euthanased or culled zoo animal carcasses to zoo carnivores is no longer common practice in Australia, although it may be done on rare occasions, following appropriate risk assessment.

2.9.2 Off-site veterinary diagnosis and treatment

Occasionally, individual zoo animals are transported off-site for short periods to attend either primary or referral veterinary facilities. If minor zoos do not have a dedicated animal treatment facility on-site, transport to a local veterinary clinic may be necessary when animals require significant veterinary intervention. Zoos may be required to apply for temporary permits from the relevant regulatory authority before transporting zoo animals for temporary care.

2.9.3 Mobile zoos

Some zoos operate a 'mobile zoo' facility that takes selected collection animals outside the zoo to schools and other facilities for education and community engagement in conservation issues. The individual animals in these situations are carefully chosen (both species and individual) for their suitability for this purpose. Biosecurity is a high priority, and typically these animals are housed and cared for separately from other collection animals.

2.9.4 Unplanned movement of animals (theft and escape)

Zoos have several levels of security to protect their valued resources from the potential for escape or theft (see Section 2.5.5). Very occasionally, however, zoo collection animals may be stolen, either from the zoo property or while in transit from one zoo to another. Very rarely, zoo animals escape from their enclosure or, more rarely still, from the zoo premises.

With both thefts and escapes, zoos are required to meet regulatory requirements, including reporting processes. Most animals are recovered within hours. Details of thefts or escapes, such as how long the animal was absent, and how and where it

was recovered, are fully recorded. All such animals are subjected to appropriate risk assessment and biosecurity measures before their return to the zoo collection.

2.10 Inputs and outputs

A detailed discussion of inputs and outputs from zoos can be found in the *National Zoo Biosecurity Manual* (Reiss and Woods 2011).

Inputs into and outputs from the zoo will vary between zoos, but the following general principles apply.

2.10.1 Animals

A variety of species move in and out of zoos, including:

- zoo animals going to or from other institutions within Australia or overseas
- animals sourced from commercial properties within Australia
- sick, injured or orphaned wildlife arriving at or leaving the zoo
- confiscated animals
- native animals from the wild for captive breeding
- assistance animals (eg guide dogs)
- free-ranging pest, feral and native animals.

2.10.2 Feed

Because of the diversity of species held in zoos, a wide variety of feed items need to be brought into the zoo on a regular basis. Feed inputs include fruit, fish, meat, vegetables, hay, straw and pelleted feed, browse and silage. Zoos use rabbits, chickens, macropods and domestic hoof stock, sometimes in carcass form, as feed for zoo animals. Whole carcases are generally inspected by veterinarians or trained keepers for suitability before they are fed to zoo animals.

Animal feed such as hay, concentrates and pet meat is generally obtained from standard outlets. Zoos may breed 'live' feed (mice, rats and insects) on-site or source them from commercial facilities. Rarely, some zoos may cull surplus collection animals and use the carcasses as feed for carnivores.

Surplus feedstuffs may leave the zoo as an output.

2.10.3 Biological products

Biological products other than live animals may be transported on and off the zoo premises for a variety of purposes.

Specimens such as wildlife carcasses may be brought to the zoo veterinary hospital for postmortem investigation. Semen, embryos and other biological specimens may be carried into or out of the zoo for reproductive or laboratory work. Biological specimens (eg blood, bones, hides) may leave the zoo for diagnostic or research purposes, or as treated or managed waste. Carcasses of zoo animals may be sent to appropriate independent facilities for postmortem investigation, research, or taxidermy or skeletal preparation for study or display, following an appropriate risk assessment and biosecurity management procedures.

In most cases, movement of these products is tracked. Most of these movements are not intrinsic to the basic operations of the zoo and could be stopped for a period, if necessary, such as during an EAD outbreak.

2.10.4 Equipment

Equipment and other items that enter the zoo include vehicles, machinery, tools, materials used for animal housing (straw, litter, mulch, sand, gravel), equipment used during the transportation of animals (hay, sawdust, crates), medicines and other veterinary products. These items may also leave the zoo.

Animal waste products may enter or leave the facility with imported or transferred animals.

Some products may require biosecurity management procedures, such as decontamination, disinfection or biosecure packaging, before they leave the zoo.

2.10.5 People

Zoo staff, including volunteers and students, leave the zoo premises and return to the community each day, where they may have contact with other animals (domestic pets, rehabilitating or 'pet' wildlife, livestock or feral species). Contractors, maintenance personnel and service people also visit the zoo regularly. Researchers, wildlife rehabilitators and wildlife officers bring rehabilitated wildlife to the zoo wildlife rehabilitation hospital, and may have contact with non-zoo animals before and after visiting the facility.

Zoo personnel and their family members may live on the zoo premises.

Zoo staff, particularly those in contact with animals, usually have dedicated footwear and uniforms. Work footwear is often left on the premises at the end of each working day.

Under specific visitor programs, local and international visitors may have supervised close contact with particular individual zoo animals (see Section 2.4).

2.10.6 Water

Dam or creek water, as well as treated town water, may enter the zoo and be used in exhibits, for cleaning and as animal drinking water. Water may leave the zoo as managed or treated waste material. Water may also be recycled and reused within the zoo.

2.10.7 Waste products

Waste products, including food waste, animal faeces, water, animal bedding, biological products and zoo animal carcasses, often leave the zoo property for carefully managed disposal at a remote site, observing relevant regulatory and biosecurity requirements. All waste is carefully managed on the zoo premises and during disposal. Zoo compost is occasionally sold to the public after appropriate risk assessment and management.

3 Emergency animal disease risk reduction and contingency planning

3.1 The risk of entry of an emergency animal disease

Emergency animal diseases (EADs) with the potential to affect zoo animals in Australia are most likely to emerge outside the zoo and move into the zoo to affect animals on the premises. Therefore, the risk factors associated with an EAD in other animal industries are also relevant to the zoo industry.

3.1.1 General EAD risks associated with zoos

In general, the EAD risk associated with zoos is low. Zoos are unique operating environments with a risk profile that is different from that of other livestock industries because of the nature of zoo operations. Specific risks to consider include:

- housing of multiple species in close proximity
- housing species in proximity that may not cohabit in the wild
- the potential for wild (including feral) animals to free range within zoo grounds
- the potential for close mixing of collection and free-ranging wild animals
- temporary holding of confiscated nondomestic animals of unknown origin and health status (see Section 2.8.2)
- large numbers of visitors, including international guests
- the potential for close human–animal contact
- gaps in diagnostic and epidemiological science for nondomestic species.

These risks are recognised by zoos and managed through standard operating procedures and appropriate biosecurity processes.

3.1.2 Risk factors for importation of zoo animals

In general, the EAD risk associated with importation of zoo animals is very low (see Section 2.8.1). Importation of zoo animals is strictly regulated by the Australian Government Department of Agriculture. The small number of zoo animals that are imported significantly reduces the risk. There is very little potential for direct contact between zoo animals and livestock or pet animals during transport of animals or after their arrival in Australia.

Factors that may influence the EAD risk associated with importation of zoo animals include the relatively limited information on the epidemiology of some infectious diseases in nondomestic species. In many cases, it is not known whether taxonomically related nondomestic species are susceptible to EADs that affect domestic animals. In addition, there may be a lack of diagnostic tests validated for nondomestic animals, both within Australia and internationally. Often, the test used for the most closely related domestic animal must be used. Taxon-specific tests have been developed for some nondomestic animals, particularly if the

disease is of primary concern in that species. These risks are considered and addressed during the development of taxon-specific zoo import requirements by the Department of Agriculture.

3.1.3 Risk mitigation

Although the risk of an EAD outbreak in zoos is low, the consequences to the Australian zoo industry are potentially high. Appropriate biosecurity, EAD awareness and preparation are therefore key concerns for all zoos. The *National Zoo Biosecurity Manual* (Reiss and Woods 2011), which has been written and adopted by the Australian zoo industry, presents guidelines in best practices for biosecurity in zoos. Adoption of these practices significantly reduces the risk of an EAD outbreak, maximises early detection and assists with control measures in a zoo setting.

Any potential EAD risk in zoos is mitigated by the way in which zoo animals are managed. Numbers of individual animals are low, and each individual is closely observed on a daily basis. Preventive medicine programs are well developed by veterinary staff with experience and expertise in zoo animal medicine. Breeding rates are controlled, and animals are never shipped to stockyards, saleyards or abattoirs. Zoo animals have little opportunity for direct contact with other domestic species in Australia. Biosecurity practices appropriate to public visitation and visitor interaction with zoo animals are maintained. Newly arrived animals at a zoo, including wildlife rehabilitation cases, are quarantined. Wildlife is managed separately from zoo collection animals, and any animals regularly moving out of the zoo (eg mobile zoo animals) are compartmentalised from the rest of the zoo collection.

Appropriate planning and response during both 'peacetime' and an EAD outbreak can minimise any negative impacts on zoos. Zoos should have an institution-specific emergency response plan to deal with emergency events (focusing on natural disasters and animal escapes, but with general principles that apply also to EADs). Zoos should also have an institution-specific biosecurity response plan to deal with biosecurity emergencies, such as an EAD outbreak. The *National Zoo Biosecurity Manual* (Reiss and Woods 2011) provides details to assist with the development of a biosecurity response plan.

Zoo biosecurity practices and the relative isolation of most zoos from other livestock provide the greatest security to zoos in the event of an EAD outbreak in an area close to the zoo.

Pre- and post-arrival quarantine risk management measures, the physical separation of zoos from livestock, and the general high level of biosecurity in zoos mean that it is extremely unlikely that an EAD, if present, would spread from the zoo premises and gain wider distribution.

Most highly infectious disease agents are transmitted via contact with infected animals. Movement of zoo animals between institutions, and direct or indirect contact between zoo animals and domestic animals or wildlife pose the greatest risk of disease spread. Some infectious agents can be spread mechanically on inert materials, including vehicles, clothing and equipment. A standstill on movements of animals and potentially infectious materials is one of the immediate and most effective ways to control the spread of an EAD.

3.2 Impacts of an EAD on a zoo

Diagnosis of an EAD in or near a zoo could have a very significant impact on the zoo. An EAD distant from a zoo could also have significant impacts if widespread control measures are put in place or if there is a public perception of risk associated with the zoo. Zoo managers and staff need to be aware of these potential impacts and consider them as part of contingency planning, to ensure that any potential impacts on the zoo are minimised. Knowledge of the procedures used by government authorities to control EADs will help zoo managers to prepare a zoo EAD response plan to be used when an EAD is suspected or confirmed. This will complement the work of the disease control authorities managing the response and assist in the development of a collaborative approach to managing the EAD.

For a highly infectious EAD such as foot-and-mouth disease (FMD) or equine influenza, a national standstill on susceptible animals would be applied for 72 hours. If any zoo animals are in transit, specialist and intensive management will be required. Other than in this circumstance, a national standstill is unlikely to cause significant difficulties for the zoo industry. However, movement restrictions within the declared area may continue for an extended period. If the zoo premises is within the declared area, this may have significant impacts on feed availability for zoo animals, since the majority of food and feed items need to be transported into most Australian zoos.

During an EAD outbreak, the focus of the authorities will be on minimising disease spread, minimising disease amplification and stamping out the disease. The focus of the zoo will be on preventing spread of the disease if it has arisen within the zoo, or maintaining business continuity and preventing disease from entering zoo premises if the EAD has arisen outside the zoo.

Zoos typically hold a diverse range of exotic and native species. Each zoo is unique in its location; its arrangement of enclosures; and the mix, proximity and range of individual animals and species. In addition, scientific information on the susceptibility of zoo species to specific diseases and the possible role of these species in disease transmission may be lacking. Because of this variability and uncertainty, it is impossible to predict the impacts of a particular EAD on a zoo. Despite the challenges, generalisations can be made, and a hierarchy of increasing EAD response actions and impacts will apply, as follows:

- a zoo located outside the declared area (see Section 3.5.2, Scenario 3)
- a zoo with no suspicion of an EAD located within the declared area, or a zoo classified as a suspect premises or trace premises (see Section 3.5.2, Scenario 2)
- a zoo with an actual EAD (infected premises) or evidence of contact with infection (dangerous contact premises) (see Section 3.5.2, Scenario 1).

3.2.1 Significant impacts

The most significant potential impacts of an EAD on a zoo will be on the zoo's business, and may include the following:

- The zoo is forced to close to visitors, with significant impact on income and business continuity.
- The zoo is required to euthanase collection animals.
- The zoo has significant disease and/or high mortality in collection animals.

- The zoo's operations are affected by movement restrictions on staff.
- Staff and/or visitor health is affected by zoonotic aspects of an EAD.

Other significant potential impacts include:

- decreased visitation due to public perception of the zoo as a place of zoonotic disease risk
- logistical and financial impacts of ongoing testing and treatment of animals for disease, and associated risk management processes
- logistical and financial impacts associated with increased biosecurity requirements
- negative animal welfare impacts of disease or necessary management strategies; these could include impacts on enclosures (such as removal of substrate or cage furniture), and destruction, decontamination or modification of housing
- restrictions on animal movements between and within zoos, which may also disrupt species management programs
- ongoing human health concerns (including staff concerns) about disease in humans, or potential for human health involvement
- anxiety and uncertainty over the short-term and long-term future for animals, staff and the business
- poor messages to the public that do not reflect the true situation in zoos, with subsequent revenue loss or impacts on business reputation.

3.2.2 Zoo operations — can the zoo continue to operate?

The ability for a zoo to continue operating in the event of an EAD infection on the premises depends on the type of disease and the nature of the outbreak. Some staff will need to attend the zoo to care for animals and perform other essential tasks. Entry of other staff and visitors may be prohibited, and increased biosecurity measures are likely to be required for both people and other inputs.

Zoos generally have a high level of security (secure perimeter fences and supervised gates) and can be quickly and effectively contained, if necessary. Major zoos have established emergency procedures, well-developed chains of command and communication pathways. Zoos are compartmentalised by nature and can review and strengthen compartmentalisation of various operational and animal holding areas within the zoo premises.

In most EAD outbreaks in Australia, zoos that are not directly affected would be able to continue to operate. However, depending on the zoo's location relative to the outbreak, some initial movement restrictions and additional hygiene and security measures may be imposed.

3.2.3 Valuation and compensation

It may be difficult to put a monetary value on rare and endangered species, and the cost of replacement of zoo animals may be substantial. In some cases, animals may be irreplaceable. These facts need to be taken into account during response planning. The decision to cull animals should not be taken lightly and must occur in consultation with zoo and species management teams. In some circumstances, a modified stamping-out approach may be used. In Australia, management of

endangered and listed species is coordinated by the Australasian Species Management Program, administered by the Zoo and Aquarium Association (ZAA). Because of the controlled nature of the zoo environment and the close management of zoo animals, quarantine and/or vaccination and lifetime monitoring of genetically valuable animals may be a viable and preferable alternative to destruction of animals.

Appendix 5 contains further details on the policy of the EAD Response Agreement.[15]

3.3 Management of risks before and during an EAD outbreak

The single most important thing that zoos can do to manage and minimise risks in advance of and during an EAD outbreak is to ensure that routine biosecurity practices are in place. The *National Zoo Biosecurity Manual* (Reiss and Woods 2011) provides details of routine work practices and processes to minimise the risk of disease. Some general practices that can be used to manage the risk in advance of and during an EAD outbreak, and practices that can minimise the risks of disease entry or escape from the zoo are listed in the following sections.

3.3.1 Minimising EAD risks before an outbreak

Recommended practices to minimise EAD risks before an outbreak include:

- having effective perimeter fencing to prevent access of unwanted terrestrial pests and domestic animals
- ensuring that routine biosecurity practices are in place, practised and reviewed regularly; this includes ensuring that dedicated work boots and uniforms are left at the zoo at the end of the work day
- maintaining good veterinary services that focus on preventive medicine, generation and recording of baseline data, and the need for EAD preparedness
- developing and maintaining appropriate quarantine processes and facilities, including creating high-security isolation areas for different types of animals (large and small)
- having an effective pest management strategy
- constructing exhibits and holding yards to minimise the risk of disease spread and provide options for holding animals in contained areas
- maintaining a clean, uncluttered environment in both on-display and off-display areas
- maintaining documented, standard work practices that minimise the risks of disease transmission
- establishing risk-based cleaning and disinfection procedures for vehicles moving through open-range zoo enclosures, before they leave and re-enter the zoo premises.

[15] www.animalhealthaustralia.com.au/programs/emergency-animal-disease-preparedness/ead-response-agreement

Activities that can improve preparedness and response include:

- investigating ill-health in collection animals and free-ranging species in zoo grounds, and undertaking regular disease surveillance in wild animals free ranging in and around the zoo
- performing appropriate postmortem examinations and diagnostic tests on dead collection and free-ranging species
- developing an institution-specific general emergency response plan and a biosecurity response plan, including a communications strategy (note: in an EAD incident, a specific response plan will be developed by the state hazard management agency for that incident)
- maintaining detailed, well-organised and easily accessible records of movements of animals, people, feed, waste and other items, which will help with tracing
- training staff in emergency response, biosecurity and EAD preparedness, including specific roles to be performed during an emergency, biosecurity training for key staff and EAD training for veterinarians
- developing institutional awareness of zoo species that are at high risk of contracting an EAD, and risk pathways
- becoming an active institutional member of a zoo industry association that encourages education and information sharing, particularly in the areas of biosecurity, emergency response and response preparedness
- storing frozen serum collected during routine procedures on zoo animals
- regularly sampling animals and establishing baseline physiological values
- exercising laboratory capacity for detection of exotic or emergency diseases (eg avian influenza virus screening of wild or zoo birds as part of surveillance activities)
- conducting emergency simulation exercises.

Additional activities include conducting research into the epidemiology, diagnosis, treatment and prevention of EADs in nondomestic and wildlife species (eg zoo-based research, or research by other competent authorities such as universities and government diagnostic and research facilities).

3.3.2 Managing risks of an EAD entering the zoo during an outbreak

Zoos located within a declared area can take a number of steps to improve their existing biosecurity programs and reduce the likelihood of an EAD entering their properties. The specific actions that can be taken will depend on the institution and its circumstances. Many of these biosecurity actions are documented in the *National Zoo Biosecurity Manual* (Reiss and Woods 2011). The focus of risk management will be on inputs to the zoo, since this is how disease will enter the premises.

All inputs into the zoo should be reviewed and subjected to a risk assessment, with appropriate action taken as indicated by the risk assessment and determined by the jurisdictional authorities. This requires specific knowledge of how the EAD in question is transmitted (including vector pathways); see the relevant **Disease Strategy** or **Response Policy Brief**. Specific actions that may be requested by jurisdictional animal health authorities are listed below.

Cease activities:

- Stop animal transfers from other institutions.
- Stop movement of mobile zoo animals into the general zoo collection.
- Stop all other non-essential inputs (eg stores, gift shop deliveries).
- Stop feed inputs (or source feed only from 'safe' sites).

Modify activities:

- Review and increase biosecurity measures for staff and others, if indicated (eg use of footbaths and personal protective equipment, change of footwear and clothing, disinfection).
- Restrict or stop entry to the premises of students, volunteers and contractors.
- Restrict or stop visitor movements within the property, particularly close interactions of people with at-risk taxonomic groups.
- Restrict vehicles entering the property and consider disinfection of vehicles, if necessary.
- Disinfect essential inputs, if necessary.
- Review vertebrate and invertebrate pest management, and adjust procedures as required to limit dispersal of disease via potential wildlife or invertebrate vectors. The emphasis should be on identifying and managing free-ranging vertebrate vectors (eg wild birds, terrestrial wildlife, feral animals), as well as invertebrate vectors (see the **Wild Animal Response Strategy**).
- Where possible, house at-risk animals indoors or in controlled environments.

Vaccination:

- Vaccination of zoo animals may be considered during an EAD event, under an agreed specific response plan, and if a vaccine relevant to the disease is available. The use of vaccination is a complex issue, and the policy will be agreed upon by the Consultative Committee on Emergency Animal Diseases (CCEAD) and the National Management Group. Vaccination may be approved to protect valuable animals and remove the need for pre-emptive culling as a control measure. The Australian zoo industry has been active in working with authorities to develop guidelines for vaccination of zoo animals in the event of an EAD. Guidelines for vaccination of zoo birds were endorsed in 2010,[16] and the industry is currently working with authorities to develop guidelines for use of FMD vaccine in zoo animals.
- A number of unique factors further complicate decision making on vaccination; for example, the safety and efficacy in zoo animals of many domestic animal vaccines is not established. There are operational difficulties in vaccinating zoo animals and in effectively achieving booster vaccinations. For these reasons, the potential role of vaccination as part of the zoo-based response should be discussed and the approach agreed early in the response.

[16] www.animalhealthaustralia.com.au/wp-content/uploads/2011/04/Guidance-AI.pdf

3.3.3 Managing risks of an EAD moving out of the zoo

If the zoo is considered infected or at high risk of infection, it will have to assess and manage outputs during an EAD event. The nature of the response will be determined by the disease agent involved.

As with inputs, all outputs from the zoo should be reviewed and subjected to a risk assessment, with appropriate action taken as indicated by the assessment and determined by the jurisdictional authorities. This requires specific knowledge of how the EAD in question is transmitted (including vector pathways); see the relevant **Disease Strategy** or **Response Policy Brief**. Specific actions that may be requested by jurisdictional animal health authorities are listed below.

Cease activities:

- Stop keepers who have susceptible species (relevant to the specific EAD) at home from working with infected and/or high-risk animals at the zoo. For example, in an outbreak involving equids, keepers who routinely care for zoo equids and also have horses or donkeys at home may need to be replaced by keepers who do not interact with equids outside the zoo.
- Stop the departure or release of collection animals and animals scheduled to be returned to the wild as part of rehabilitation programs until risk assessment can occur.
- Stop mobile zoo (education) animals leaving the property until risk assessment can occur.

Modify activities:

- Limit access to high-risk areas of the zoo to essential staff only, and increase biosecurity practices (eg use of footbaths and personal protective equipment, change of footwear and clothing, disinfection).
- Review and increase biosecurity practices for staff and visitors to other areas of the zoo. This may include restricting access to zoned buffer areas within the zoo.
- Review risks associated with vehicles leaving the property and restrict, if necessary.
- Review the risks associated with solid waste leaving the property (eg faeces, waste food, bedding) and modify, if indicated. Waste may need to be stockpiled within the zoo or treated before it leaves the zoo. Biosecurity practices for waste relocation may also need to be increased (eg bagging or binning waste before relocation, and/or relocating to a secure site).
- Review the risks associated with water and other discharges leaving the property. Water and other discharges may need to be stored within the zoo or receive additional treatment before leaving the zoo. The *National Zoo Biosecurity Manual* (Reiss and Woods 2011) discusses management of water and other discharges in zoos.
- Implement disease-specific risk-based management for biological specimens leaving the zoo (eg diagnostic samples, carcasses, research samples).
- Review vertebrate and invertebrate pest management, and adjust procedures as required to limit dispersal of disease via potential wildlife or invertebrate vectors.

3.4 Detailed actions by the affected zoo during an EAD

As well as general practices that can be used to manage the risk before and during an EAD outbreak, a number of detailed actions can be taken by the affected zoo during an outbreak. High priorities are liaising with the authorities, public relations and communications, and development of the response plan.

3.4.1 Liaison with authorities

An EAD outbreak in Australia will be declared by the CCEAD. When an EAD is confirmed, a local control centre (LCC) will be established by the lead agency (usually the jurisdiction's biosecurity agency) to control all activities within the declared area, including disease investigation, sample collection, quarantine of properties, disposal of livestock and decontamination of properties. The LCC will liaise directly with the zoo regarding any control actions that may involve the zoo. A site supervisor from the government authority may be appointed to liaise directly with the nominated senior zoo delegate.

Where relevant, the zoo industry may have technical representation on the CCEAD through the regional veterinary officer or a similar technical expert agreed by the zoo industry.

Two important initial actions for the zoo to take will be to nominate:

- a senior person with overall management of the response within the institution (to act as institutional incident controller)
- a senior person to act as liaison between zoo management and the state or territory disease control authorities. This person will be responsible for ensuring that communication is maintained; and that there is a strong, direct communication line between the zoo's director and technical experts (eg the zoo's senior veterinarian) and the relevant authorities.

A dedicated zoo industry liaison person will also be required to interface with the CCEAD, the LCC, the affected zoo (or zoos) and the rest of the zoo industry. The Australian zoo industry should maintain a pool of key technical specialists who have received CCEAD training (eg members of the Zoo Animal Health Reference Group and senior veterinarians of major zoos).

3.4.2 Public relations and communications

An EAD event involving a zoo is likely to generate intense media focus and a high level of public interest, because of concerns about risks of disease spread to visitors, animal welfare, endangered species and the valuable animals held. There will be particular concern if endangered or high-profile species are involved in the event, particularly if destruction of animals is a possibility. **Communication within the zoo, with authorities responding to the EAD outbreak, with the media and the wider community, and with the zoo industry as a whole must be a priority during an EAD outbreak** (see also the **Public Relations Manual**).

A complete and frank exchange of information between the authorities and zoo staff, media personnel and the public will make a valuable contribution to the overall success of any control program. Calculated but prompt responses to media inquiries will establish mutually productive links between authorities and media personnel. Acceptance of the media's rightful role in publicising an outbreak,

especially at a location such as a zoo, will ensure more harmonious liaison between parties involved in the event.

The zoo (with assistance from the LCC and the CCEAD) should develop a communications strategy for both internal communications (with zoo staff about changes in work practice, etc) and external communications (with authorities, the public via the media, and other zoos via the zoo industry liaison person). Effective management of the wide range of public interest groups and the media will be necessary, as will management of intense demands for interviews and footage from zoo sources.

EAD communication requires a senior zoo staff member to be designated as the zoo media officer (ZMO). A suitable person to fill the role of ZMO is the zoo director or a senior staff member nominated by, and in close communication with, the director. Many major zoos have dedicated media communications officers and teams who will support the ZMO during an EAD outbreak. The ZMO is responsible for ensuring that relevant zoo staff are kept adequately informed as the event progresses. The ZMO should be advised immediately, and kept fully up to date, on any incidents likely to result in the declaration of a zoo disease emergency.

As part of an EAD response, a communication pathway will be developed by the chief veterinary officer (CVO), the zoo incident controller and the CCEAD. This might include the ZMO of the affected premises, the ZAA regional veterinary officer, the convenor of the ZAA Veterinary Specialist Advisory Group, the Zoo Animal Health Reference Group and Wildlife Health Australia.

The communications strategy within the zoo should be overseen by the ZMO and should aim to achieve:

- rapid and effective information flow and media operations in the event that the EAD may affect or threaten an Australian zoo
- an up-to-date, constant flow of accurate information to
  - staff within the zoo
  - key personnel at other zoos
  - key personnel at relevant organisations (ZAA, Wildlife Health Australia, other wildlife care networks)
  - other organisations holding nondomestic species (if appropriate)
  - media outlets and, via them, the general public
- the cooperation of zoo staff, by keeping them fully informed about what is happening and what is likely to happen in the context of animal management and general activity on the premises.

The communications strategy should take into account the potential for unauthorised messages to be circulated (eg through social media).

The ZMO will need to work closely with relevant staff and the peak industry representatives, such as the ZAA, to ensure that the wider zoo industry is well informed of events.

3.4.3 Response plan of the zoo

The authorities will strongly emphasise development of a response plan. They will develop a formal response plan, and will also expect the zoo to generate an internal response plan, which may draw heavily on advice provided by authorities. The realities of the response will mean that initial plans are working documents that are refined and further developed as the response progresses. Key elements for plans will include disease control measures, risk assessment, identification of management options and communication strategies, and implementation.

In all cases, the response will be based on the policy framework and processes described in the relevant AUSVETPLAN manuals (**Disease Strategies** and **Operational Manuals**). The zoo will need to work with the authorities to implement relevant aspects of the response plan.

Elements of the response plan will influence the affected zoo's own internal response plan, which will also need to be developed as a high priority.

Consideration needs to be given to managing continuing zoo operations under any restrictions that might be imposed. Whether the zoo remains open or is required to close is discussed in Section 3.2.

3.5 Scenarios

Different EAD scenarios (see Section 3.5.2) will affect the details of the response by the zoo, and the level of the response will largely depend on the level of risk. However, a number of common actions will need to be considered by the affected zoo in all EAD scenarios.

3.5.1 Detailed actions by the affected zoo for all EAD scenarios

The following actions will need to occur in any EAD scenario:

- Establish internal and external communication pathways and responsibilities for management of the event (including notification of the authorities, appointment of a ZMO and zoo industry liaison person, and communication with staff).
- Identify the immediate actions required and the risks specific to the zoo's circumstances (location, species held, work practices), and assess disease threats to and from staff and visitors.
- Review and, if necessary, stop, minimise or modify (as required by authorities)
  - between-zoo animal transactions
  - other collection animal movements (eg mobile zoo)
  - staff movements (within zoo, and into and out of zoo)
  - inputs and outputs (eg vehicles, food, water, equipment, biological samples, waste)
  - visitor movements around the zoo and visitor–animal contact, including interactive programs (eg behind-scenes tours)
  - wildlife hospital admissions and management practices

  - planned releases of animals into the wild.
- Review (as required by authorities)
  - all biosecurity arrangements — the *National Zoo Biosecurity Manual* (Reiss and Woods 2011) provides information and guidelines on standard biosecurity practices
  - staff work practices, including staff contact with at-risk domestic animals outside the workplace
  - animal management practices within the zoo (eg workflow; housing and proximity of animals on display to other individuals of the same species, other animal species and humans; potential removal of animals from display to indoor facilities)
  - pest animal control and monitoring within zoo grounds
  - management and monitoring of free-ranging wildlife within zoo grounds.
- Document all additional actions and modifications in protocols, and communicate all changes to staff.
- In conjunction with authorities, develop plans and implement procedures for
  - quarantine and isolation of at-risk or infected animals
  - decontamination of equipment, premises and personal clothing; in the zoo situation, there may be unique challenges in disinfecting or destroying facilities (see the **Decontamination Manual**)
  - euthanasia of zoo animals and free-ranging wildlife/feral animals in the zoo grounds (see the **Destruction of Animals Manual**)
  - disposal of zoo animal and wildlife carcasses following either euthanasia (related to the EAD outbreak) or natural deaths, and disposal of other infected waste products (see the **Disposal Manual**); there may be unique considerations associated with disposal of carcasses of large zoo animals
  - epidemiological review and tracing
  - communications with the community, staff, other zoos and other facilities, as relevant (see the **Public Relations Manual**)
  - disease screening and possible vaccination of at-risk animals (see the relevant **Disease Strategy** or **Response Policy Brief**)
  - appropriate health care of at-risk staff (in consultation with medical authorities).
- Perform surveillance and establish proof of freedom, as required by authorities (see Section 3.6).

3.5.2 Detailed actions by the affected zoo for specific EAD scenarios

The three most common scenarios that will need to be managed are:

- a zoo with an actual EAD (infected premises) or evidence of contact with infection (dangerous contact premises) (see Scenario 1)
- a zoo with no suspicion of an EAD located within the declared area, or a zoo classified as a suspect premises or trace premises (see Scenario 2)
- a zoo located outside the declared area (see Scenario 3).

Scenario 1 — EAD diagnosed within the zoo

If zoo animals have been diagnosed with an EAD, or are known to have been in direct contact with infected animals, the zoo would be declared an infected premises or a dangerous contact premises.

The EAD will probably be diagnosed at a government-based laboratory, and the zoo's management and veterinary service will be informed that an EAD has been diagnosed on the property, either by the laboratory or by the authorities dealing with the EAD. Alternatively, before diagnosis, the zoo (via its management or veterinary service) will inform authorities of any suspicion of an EAD within the zoo. In this instance, the zoo should immediately put in place precautions (quarantine and standstill) pending confirmation of the diagnosis.

The main aim of management procedures will be to prevent the EAD from leaving the zoo, and the focus will be on managing outputs (see Section 3.3.3). Another high priority for the zoo will be to minimise impacts on zoo business.

The level of response will differ slightly, depending on whether the EAD was already present outside the zoo, with the zoo subsequently becoming infected (the more likely scenario), or the EAD arose and was first diagnosed within the zoo (an unlikely scenario).

Immediate actions

Simultaneous responses will be to:

- inform the regulatory authority (upon first suspicion of infection)
- notify internal zoo management
- develop a communications pathway and responsibilities
- impose a standstill on inputs and outputs
- impose biosecurity measures.

Day 1 to several weeks

In the first week(s) of the response, response personnel in conjunction with authorities will:

- collaborate with the regulatory agency that has the legal responsibility for managing the EAD response, including developing the response plan
- undertake a risk assessment, including assessment of human health and safety, and evaluation of disease testing options, including
  - practicalities for the species and circumstances involved
  - known or estimated species sensitivity and specificity for each test
  - time for results to become available
- identify management options (with ongoing review of risk assessment), including
  - movement of people and things, including vehicles
  - decontamination
  - zoning

  - broad disease screening
  - treatment and vaccination, if appropriate
- implement a zoo-specific response plan, including consideration of
  - culling or alternative management measures, including vaccination (if appropriate) and enhanced biosecurity within the premises
  - disposal of carcasses and contaminated material (see the **Disposal Manual**); disposal of carcasses of some very large animals may present challenges and will be supervised by LCC staff
  - decontamination of equipment and, where possible, environments (see the *National Zoo Biosecurity Manual* (Reiss and Woods 2011)); the LCC will advise on the risks and appropriate disposal or decontamination of products and environments
  - tracing (see the *National Zoo Biosecurity Manual* (Reiss and Woods 2011))
- develop an early communications strategy (both internal and external).

Consideration also needs to be given to managing continuing zoo operations under any restrictions. Some processes may take time to develop, and some actions may not be undertaken until sufficient information is available, or until sufficient resources are in place to conduct operations.

It is possible that the zoo might have to destroy zoo animals if the zoo is shown to be infected. Given the unique operating environment, animals involved and considerations, compartmentalisation might be considered to minimise the need to destroy zoo animals.

First week to months

After the first week(s), actions will focus on surveillance and establishing proof of freedom (see Section 3.6), as determined by the LCC and state or territory control centre (SCC) planning sections.

Scenario 2 — zoo falls within a declared area

In this scenario, the zoo is considered at risk of acquiring the EAD because it lies within either the restricted area or the control area declared for the outbreak. The main aim of any risk management procedures will be to prevent the EAD from entering the zoo, through increased biosecurity and a focus on assessment and management of inputs (see Section 3.3.2).

Because of the expertise available in most zoos, authorities may ask for the zoo's assistance in gathering information on disease in free-ranging wildlife outside or within zoo grounds. Zoo managers will need to be aware, and assess the potential risk, of this type of surveillance process to the zoo and negotiate any involvement of zoo personnel in wider surveillance activities coordinated by authorities. Testing of zoo animals may also be required; this will be based on risk assessment in consultation with the LCC.

Should the EAD be diagnosed within the zoo, actions associated with Scenario 2 would merge into Scenario 1.

Scenario 3 — zoo located outside the declared area

This scenario involves diagnosis of an EAD at a distance from the zoo, within either Australia or Australasia. Although there is no imminent EAD threat to the zoo, good practice would require the zoo to develop and implement a response strategy in advance of an increasing threat.

There may be discussion between regulatory authorities, veterinary services and zoo managers on specific disease risk management plans (eg vaccination, routine health screening, pre-exposure serum and sample collection). Given the considerable expertise and capability within the Australian zoo industry, discussions might also address the zoo's participation in any proposed national surveillance strategy involving either collection animals or wildlife, which could benefit the national surveillance effort. A recent example is the response of Australian zoos to highly pathogenic avian influenza H5N1 in Asia. Australian zoos reviewed their preparedness for H5N1, updated response and contingency plans, and contributed to national general surveillance activities in wild birds.[17]

Any plans developed as part of Scenario 3 should be reviewed and modified in response to the changing circumstances of the EAD outbreak, and responses from Scenarios 2 and 1 should be adopted as required. For all scenarios, EAD response actions and impacts would be either escalated or downscaled from one scenario to another, as required.

3.6 Proof of freedom

Options for surveillance should be discussed early in the response. At the appropriate time, a process to demonstrate proof of freedom will also need to be devised for the premises, in consultation with the LCC.

Differentiation of exposed, infected and uninfected animals, and establishing proof of freedom, may be extremely difficult in zoo animals because numbers of animals are often very low, and many of the routine diagnostic tests developed for use in production animals have not been validated in zoo animals. This makes interpretation of results difficult at both an individual and a herd level. Furthermore, the epidemiology of the EAD may be different in zoo species, or may be unknown. The logistics of collecting samples may be challenging; each animal might need to be anaesthetised. In many cases, zoos will have access to stored sera and tissues from collection animals, collected as part of routine health procedures. This material could be useful in developing or modifying specific laboratory tests and interpreting results.

Regardless of the complexities, intensive testing of zoo animals and ongoing surveillance of animals in and around the zoo may be required.

The **Disease Strategies** give details of how proof of freedom can be re-established for each disease. The World Organisation for Animal Health (OIE) *Terrestrial*

[17] Many Australian zoos contribute data to the National Wildlife Health Information System and provide a framework that could rapidly be activated for supporting targeted activities.

Animal Health Code sets international requirements for proof of freedom for a wide range of diseases.

The decision to declare freedom from a particular disease and cease disease control activities will be made by the CCEAD and the state or territory CVO. Given the unique operating environment of zoos and the animals involved, compartmentalisation could be a useful tool as part of planning for surveillance activities and demonstrating proof of freedom for the industry.

3.6.1 Surveillance

Zoos are well placed to conduct ongoing surveillance on both animals in their collections and free-ranging wildlife and feral animals in the area of the zoo. Surveillance efforts may range along a continuum. In some instances, close observation of collection animals several times a day, by staff familiar with the individuals, may allow early detection of disease through changes in behaviour, activity and appetite. There are some constraints on sampling zoo animals, generally centred around their nondomestic nature and difficulties in immobilising them for examination.

The nature and extent of surveillance for each EAD will depend on the disease in question.

3.7 Specific EAD risks for zoos, based on type of agent and route of transmission

Most major Australian zoos are alert to the risks of transmission of an EAD in the zoo environment, and implement routine strategies to manage these risks. Most zoos also have the ability to implement appropriate procedural changes in the event of increased risk of disease transmission. Minor zoos might have a smaller knowledge base, capability and capacity.

Zoos hold a wide range of collection species, in close proximity to each other. The diverse mix of species and the proximity of animal holding facilities to each other may increase the potential for disease transmission between species, including between species that would not normally be in proximity outside a zoo setting.

Six modes of transmission for EADs, relevant to zoo circumstances, are outlined below. Appendix 2 provides details on each relevant disease.

3.7.1 Diseases carried by free-ranging wildlife and feral species (eg birds)

Wild animal species (including pest and feral animals) may live on, or visit, zoo premises, and these animals may come into contact with zoo collection animals. The disease risks posed by these wild animals must be considered in any EAD situation.

Zoo management programs to control these wild animals could be strengthened during an EAD outbreak (see Section 2.7). However, zoo collection animals may still occasionally interact with, predate on and/or consume free-ranging wild animals. Knowledge about the role of free-ranging animal species in EAD epidemiology might be limited. During an EAD outbreak, destruction of wild animals might be recommended to minimise the risks of disease spread. However, the capacity to capture, test or destroy these animals may be limited by both

logistics and regulations to protect wildlife and other animals. Bat viral diseases are specifically covered in Section 3.7.5.

3.7.2 Arthropod-borne diseases

Zoos often have water bodies and other areas for housing or display purposes, particularly for collection waterbirds. These water bodies can attract itinerant and/or resident wild waterbirds, as well as providing a breeding environment for arthropods (eg mosquitoes). Free-ranging birds may be further encouraged by public feeding of animals within the zoo premises. Together, these factors could promote spread of arthropod-borne diseases, including diseases with a wildlife reservoir.

Preventing the spread of arthropod-borne diseases may present challenges for zoos. These include limitations on the use of chemical control of arthropods because of risks of toxicity to zoo collection species, and the possible need for zoos to deliberately attract or manage insects as a food source for collection animals.

Practices to minimise spread of arthropod-borne diseased include:

- use of anthelmintic/insecticide treatments on animals and dens; however, unlike domestic livestock, many zoo animals can only be handled using anaesthetic or sedation techniques, reducing the ability to use topical treatments
- housing susceptible animals indoors during risk times.

Epidemiologists and entomologists can assist with disease risk assessment, insect identification and virus isolation, if insect traps are placed around the zoo.

3.7.3 Fomite-borne diseases

Zoos have a wide variety of inputs and outputs that may act as vectors or fomites for infectious disease. They include biological materials and waste from a wide range of species (see Section 2.10), as well as food for zoo animals, including fish, meat, insects and farmed invertebrates, rodents, rabbits, day-old chicks, other birds, hay, straw, fresh-cut browse, fruit, vegetables, prepared stockfeeds, eggs, milk, honey and other processed human food products. Other types of fomites include cardboard cartons brought into the zoo for use as enrichment items in animal enclosures; different types of enclosure substrate (mulch, soil and sand), which are regularly replaced and hence enter and leave the zoo; and buses transporting the viewing public through open-range zoos. Processed and fresh food is brought into the zoo by catering companies to feed visitors.

Zoo staff may have close contact with domestic and wild animals outside the zoo, as well as with the zoo animals in their care. Large numbers of visitors may be moving through the zoo every hour, and visitors may experience close contact with zoo animals. These risks need to be managed (see Section 2.4).

3.7.4 Zoonotic diseases

Diseases can pass from humans to zoo collection animals, as well as from animals to humans (both staff and visitors). Zoonotic disease risks to staff, visitors and collection animals are minimised through well-established and documented standard operating procedures (see also the *National Zoo Biosecurity Manual* (Reiss and Woods 2011)). Most zoos also have zoonosis risk management programs,

including links with human health providers, as part of their workplace health and safety programs.

Many zoos hold nonhuman primates, which are often susceptible to human infectious diseases, such as influenza.

Zoos typically have many visitors, including a high proportion of children and elderly people (who may be more susceptible to infection), and overseas visitors (who could carry unusual diseases into Australia). The increased popularity of visitor experiences involving close contact with collection animals might also increase zoonotic disease risks, if not managed appropriately. However, in almost all cases, staff have much closer contact with collection animals than visitors, with consequent higher risks of disease transmission both to and from zoo animals. Zoo staff are increasingly travelling globally, potentially increasing the chance of EAD transmission from a human to a zoo animal.

Many infectious zoonotic diseases can spread via the aerosol route, and infectious agents can travel over very long distances. Close contact with animals, although potentially raising the risk of disease transmission, is not required for the spread of many infectious diseases.

3.7.5 Bat virus diseases

Bats are increasingly recognised as playing an epidemiological role in a range of viral diseases of risk to humans and animals — in Australia, notable examples are Hendra virus and Australian bat lyssavirus.

Zoo premises often have environments that inadvertently attract both megabats and microbats, as a result of the presence of predator-protected roosting sites and food sources. Zoo collection animals may occasionally interact with (including predating on or consuming) wild bats. In most cases of infectious disease risk from bats, the likelihood of disease spillover from zoo collection species to other species is extremely low.

Zoos are aware of, and consider and manage, the risk of disease transmission from bats — for example, by managing areas under flying fox roosting and feeding sites to avoid contamination of feed and water with flying fox faeces and other excreta. Zoo managers, staff and veterinarians are also alert to the potential for a novel disease to emerge under these circumstances.

3.7.6 Diseases spread by aerosol

Some EADs are transmitted by aerosol, and isolation of susceptible animals may be necessary to minimise the risk of disease spread. Zoos often have excellent quarantine and veterinary facilities, but may have a limited capacity to move and isolate animals. In general, it may be easier for most zoos to isolate and move individual animals rather than large groups of animals (eg isolating particularly high-value animals from other animals).

3.8 Specific diseases of concern for Australian zoos

This section outlines five EADs of specific concern to the zoo industry. Details of all EADs of concern to zoos can be found in Appendix 2.

3.8.1 Foot-and-mouth disease

FMD is an acute, highly contagious viral infection of domestic and wild cloven-hoofed animals. It is characterised by fever and vesicles in (or on) the mouth, nose, feet and teats. Serious production losses can occur, but deaths are unlikely except among young animals. Pigs are considered important amplifying hosts; cattle are highly susceptible and are good indicators of the presence of disease. All wild cloven-hoofed animals are susceptible, including deer, antelope, wild pigs, elephant, giraffe, and camelids. Wildlife, other than African buffalo (*Syncerus caffer*) in Africa, has not been shown to maintain FMD virus or play a significant role in the spread of the disease. The disease has also been recorded in hedgehogs, some rodents and marsupials; however, they are unlikely to have a significant role in an outbreak. Equines are not affected by FMD.

Humans may harbour virus in the nasopharynx for up to 28 hours. The susceptibility of many species to FMD is unknown, and it is probably safest to assume that most artiodactylids may become infected.

The likelihood of FMD entering Australia via the actions of the zoo industry is very remote. A more plausible scenario could involve zoos in a wider FMD outbreak, originating outside the zoo. Although the likelihood of zoo animals contracting FMD is likely to be low, the consequences are extremely severe. As a result, the zoo industry, along with other livestock industries, considers FMD to be one of the highest risk EADs. Many zoo ungulates are housed in open-range zoos, which reduce the opportunity for close observation of individual animals. Proximity of a zoo (especially an open-range zoo) to domestic livestock, including species such as pigs that amplify FMD virus, will increase the potential risk to the zoo.

A diagnosis of FMD within a zoo could result in the destruction of all, or most, of the zoo's susceptible species, or strict isolation procedures. A diagnosis of FMD in domestic livestock close to a zoo could have highly damaging consequences for the zoo, affecting zoo business processes at many levels. National or regional movement controls imposed on feed transport (as well as animal movements) may have significant implications for zoos in terms of cost and resourcing. In the event of a national livestock standstill, zoos might also have difficulty obtaining food supplies for carnivores (eg domestic meat products). There may be significant business impacts from enforced or self-imposed closure of the zoo to the public during the EAD event.

In the event of an FMD outbreak in or near a zoo, appropriate staff biosecurity arrangements would need to be developed rapidly. A significant aspect of the risk of FMD to zoos is the lack of knowledge about how the disease behaves in zoo ungulate (and non-ungulate) species, and whether these species can become infected, and/or shed or amplify the virus.

A risk management option in the event of an outbreak may be vaccination of susceptible zoo species. Vaccination might provide some protection against clinical disease and the risk that zoo animals could shed or amplify the virus, provided that animals are not already incubating it.

3.8.2 Avian influenza

Highly pathogenic avian influenza is a lethal, generalised disease of poultry caused by specific types of avian influenza (AI) virus. Disease outbreaks occur most frequently in chickens and turkeys. Many wild bird species, particularly

waterbirds and seabirds, are also susceptible, but infections in these birds are usually subclinical. Waterbirds are suspected of being the source of infection in many outbreaks. Infection and disease have been recorded in several carnivore species, including foxes, dogs and cats. Humans, other primates, rodents, pigs, cattle, equids and rabbits are also susceptible.

Many zoo bird species may be susceptible to AI virus, and the risks will be higher if wild birds visit the zoo premises. Most major zoos have established, institution-specific preparedness and contingency plans for AI. Destruction of wild birds is impractical, and control should centre on ensuring that wild birds do not come into contact with captive birds. Some disease sampling of wild birds may be required, using appropriate personal protective equipment.

Some mammalian zoo species (eg carnivores and primates) are also susceptible to AI. Zoo felids and primates may be in contact with, and at times catch and consume, free-ranging waterfowl. Zoos also use domestic poultry as a food source for zoo animals. Zoo-based wildlife rehabilitation hospitals admit and treat free-ranging birds, including waterfowl and waders.

During an outbreak, zoos may seek permission to use AI vaccines to protect valuable birds. National guidelines for use of AI vaccination in zoo birds during an EAD outbreak have been developed in collaboration with the zoo industry.[18] Isolation of susceptible birds from free-ranging species, and appropriate biosecurity, are also important.

3.8.3 Paramyxoviruses of birds

Many zoo bird species may be susceptible to paramyxovirus diseases, including Newcastle disease (ND) and avian paramyxovirus (APMV) in pigeons. ND is a highly contagious and lethal viral disease of chickens, turkeys and other domestic birds. Viral strains vary widely in their virulence; severe strains cause rapid death. Many species of nondomestic birds are susceptible, but may not demonstrate classical clinical signs. Natural infection has been reported in humans and rodents, and a variety of laboratory animals have been infected experimentally.

Parrots and pigeons have been implicated in outbreaks overseas. The importance of nonavian species in the spread of ND is not known. During migration, it is expected that wild waterfowl that are more susceptible to ND will be weakened or moribund.

Destruction of wild birds is impractical, and control should focus on ensuring that wild birds do not come into contact with domestic birds.

APMV, a virus related to ND virus, has recently been detected in housed pigeons in Australia. There is potential for spillover of the virus to free-living feral and native birds, such as raptors, native pigeons and doves.

The types of risks that ND and APMV present to zoos are similar to those posed by AI. During a nearby outbreak, zoos may decide to halt visitor entry to walk-

[18] www.animalhealthaustralia.com.au/wp-content/uploads/2011/04/Guidance-AI.pdf.

through aviaries. Movement controls might also be placed on movement of susceptible species into or out of the zoo.

3.8.4 Transmissible spongiform encephalophathies

Transmissible spongiform encephalopathies (TSEs) include bovine spongiform encephalopathy (BSE) in cattle, scrapie in sheep and goats, and chronic wasting disease (CWD) in deer. All are progressive degenerative diseases of the central nervous system and are always fatal. These diseases are believed to be caused by an unconventional agent called a prion. BSE and scrapie have extremely long incubation periods; incubation in CWD is believed to be at least one year.

In Australian zoos, TSEs are most likely to be seen in ungulates or carnivores imported from the United Kingdom or other parts of Europe before 1992. Carnivores are at risk of acquiring a TSE if fed meatmeal from infected carcasses.

An occurrence or outbreak of a TSE in Australian livestock would pose little threat to zoo animals. The risks of TSEs in Australian zoo animals are currently minimised through Australia's stringent zoo animal import conditions and TSE policy. However, Australian zoos have imported animals from countries where TSEs have been diagnosed and, in 1992 and 2002, two imported zoo felids (a cheetah and an Asiatic golden cat, respectively) were diagnosed with a TSE. In both cases, disease occurred many years after importation of the animals into Australia. Felines are dead-end hosts, and the risk of ongoing disease transmission from this scenario is very low. Other imported zoo animals may potentially carry TSEs and, for this reason, the carcasses of imported zoo animals should never be used as food for other animals or humans.

Because of the implications of Australia reporting a TSE, this remains an important EAD for zoos to consider.

3.8.5 *Mycobacterium bovis* and tuberculosis

Many species, including humans, are susceptible to mycobacterial infections. Most mammalian infections are due to *Mycobacterium tuberculosis* or *M. bovis*. Mammals are relatively resistant to *M. avium*, although exposure to *M. avium* and related mycobacteria may complicate disease testing. Ungulates, elephants and primates are the mammalian species most commonly infected with tuberculosis in zoos.

The New Zealand experience, where possums are a major continuing source of infection for cattle and deer, highlights the potential epidemiological importance of nondomestic species.

M. bovis has not been a significant disease issue in Australian zoos, due largely to the very good biosecurity procedures in place at most Australian zoos. However, the zoo industry recognises that all mammalian species are potentially at risk from this infection, and some zoo species (bovids, nonhuman primates, elephants) are extremely susceptible. Most Australian zoos have programs in place for identification of infection with *M. bovis*, but the insidious spread of *M. bovis* and the lack of validated antemortem diagnostic tests in many zoo species add difficulty to disease screening, diagnosis and outbreak management.

Other tuberculous bacteria, including *M. tuberculosis*, can cause significant disease in some zoo animals. Australian zoos have considerable experience, capability and expertise in risk management, diagnosis and treatment of these other mycobaterial

species in zoo collection animals. It can be difficult to distinguish these infections from *M. bovis*, particularly in the antemortem stages of disease. Many of these agents are potentially zoonotic, and any confirmed or suspected diagnosis in zoo animals may also require the involvement of human health authorities.

Appendix 1 List of AUSVETPLAN diseases relevant to zoos

Disease	EADRA category	OIE notifiable disease	Disease strategy	Response policy brief	Human health risk	Main species affected
African horse sickness	3	Y	Y		Nil	Horses, dogs
African swine fever	3	Y	Y		Nil	Pigs
Anthrax	3 (major outbreaks)	Y	Y		Yes	All mammals
Aujeszky's disease	4	Y	Y		Nil	Pigs, cattle, sheep, goats, dogs
Australian bat lyssavirus	1	N	Y		Yes	Flying foxes, insectivorous bats
Avian influenza (highly pathogenic H5/H7 and low pathogenicity)	3	Y	Y		Yes (HPAI)	Birds
Bluetongue (disease in sheep)	3	Y	Y		Nil	Sheep, goats, cattle, buffalo, deer
Borna disease	4	N		Y	Unknown	Horses, sheep
Bovine spongiform encephalopathy	2	Y	Y		Yes	Cattle
Bovine tuberculosis	3	Y	Y		Yes	Cattle, buffalo, deer, camelids
Brucellosis (due to *Brucella abortus*)	2	Y	Y		Yes	Cattle, horses, sheep, goats
Brucellosis (due to *Brucella melitensis*)	2	Y		Y	Yes	Goats, sheep
Classical swine fever	3	Y	Y		Nil	Pigs
Contagious bovine pleuropneumonia	3	Y		Y	Nil	Cattle
Contagious equine metritis	4	Y		Y	Nil	Horses
Dourine	4	Y		Y	Nil	Horses
East coast fever (theileriosis)	4	Y		Y	Nil	Cattle
Encephalitides (tickborne)	3	N		Y	Rare	Sheep, cattle, horses, pigs, deer
Epizootic lymphangitis	4	N		Y	Rare	Horses
Equine babesiosis (equine piroplasmosis)	4	Y		Y	Nil	Horses, donkeys

Disease	EADRA category	OIE notifiable disease	Disease strategy	Response policy brief	Human health risk	Main species affected
Equine encephalomyelitis (WEE, EEE, VEE)	1	Y		Y	Yes	Horses, donkeys, birds
Equine encephalosis	4	N		Y	Nil	Horses
Equine influenza	4	Y	Y		Rare	Horses
Foot-and-mouth disease	2	Y	Y		Rare	All cloven-hooved animals
Getah virus	4	N		Y	Nil?	Horses
Glanders	2	Y		Y	Yes	Horses, donkeys
Haemorrhagic septicaemia	4	Y		Y	Nil	Buffalo, cattle
Heartwater	4	Y		Y	Nil	Cattle, water buffalo, sheep, goats
Hendra virus	2	N		Y	Yes	Horses
Infectious bursal disease, very virulent	4	Y	Y		Nil	Poultry
Japanese encephalitis	1	Y	Y		Yes	Pigs, horses
Jembrana disease	4	N			Nil	Bali cattle
Lumpy skin disease	3	Y	Y		Nil	Cattle, buffalo
Maedi–visna	4	Y		Y	Nil	Sheep, goats
Menangle virus (porcine paramyxovirus)	3	N		Y	Yes	Pigs, flying foxes
Nairobi sheep disease	4	Y		Y	Yes	Sheep, goats
Newcastle disease	3	Y	Y		Rare	Birds
Nipah virus	1	Y		Y	Yes	Pigs, flying foxes
Peste des petits ruminants	2	Y	Y		Nil	Sheep, goats
Porcine reproductive and respiratory syndrome	4	Y	Y		Nil	Pigs
Potomac fever	4	N		Y	Nil	Horses
Pulmonary adenomatosis (ovine)	4	N		Y	Nil	Sheep, goats
Rabies	1	Y	Y		Yes	All mammals
Rift Valley fever	2	Y	Y		Yes	Cattle, sheep, goats
Scrapie	3	Y	Y		No	Sheep, goats
Screw-worm fly	2	Y	Y		Yes	All mammals
Sheep pox and goat pox	2	Y	Y		Nil	Sheep, goats

Disease	EADRA category	OIE notifiable disease	Disease strategy	Response policy brief	Human health risk	Main species affected
Sheep scab	4	N		Y	Nil	Sheep
Surra	4	Y	Y		Nil	Horses, dogs, camelids, deer, donkeys, cattle
Swine influenza	4	N		Y	Yes	Pigs
Swine vesicular disease	3	Y	Y		Nil	Pigs
Teschen disease (porcine enterovirus encephalomyelitis)	4	N		Y	Nil	Pigs
Transmissible gastroenteritis	4	Y	Y		Nil	Pigs, dogs
Trichinosis (trichinellosis)	3	Y		Y	Yes	All mammals
Vesicular exanthema	3	N	Y		Nil	Pigs
Vesicular stomatitis	2	Y	Y		Yes	Cattle, horses, pigs
Wesselsbron disease	4	N		Y	Yes	Sheep, goats
West Nile Fever	na	Y		Y	Yes	Horses

EADRA = *Government and Livestock Industry Cost Sharing Deed in Respect of Emergency Animal Disease Responses*; EEE = eastern equine encephalomyelitis; HPAI = highly pathogenic avian influenza; na = not applicable (not covered by the EADRA); OIE = World Organisation for Animal Health; VEE = Venezuelan equine encephalomyelitis; WEE = western equine encephalomyelitis

Appendix 2 Emergency diseases of concern to zoos

Because of the wide variety of taxonomic groups held in zoo collections, almost all EADs need to be considered in the zoo setting. In many cases, there is limited scientific knowledge of both the epidemiology of these diseases and the susceptibility of nondomestic species. In cases of limited information, a suitable approach is to extrapolate information from the most closely related domestic species (eg use horse information when assessing zebra).

For more details about the diseases listed below, and other EADs, refer to *Exotic Diseases of Animals: a Field Guide for Australian Veterinarians* (Geering et al 1995), the World Organisation for Animal Health (OIE) disease information summaries and technical disease cards,[19] and Wildlife Health Australia fact sheets.[20]

Emergency diseases of relevant species

The diseases of importance to zoos are briefly described below; further information is in Section 3.7. See the relevant AUSVETPLAN **Disease Strategies** for information on susceptible species, clinical signs and human health implications. Most EADs mentioned below are not present in Australia. (Refer to the *Animal Health in Australia* annual report for Australia's animal health status[21]).

African horse sickness

African horse sickness is an infectious, insect-borne orbiviral disease of horses and mules; other equines are only slightly affected. It is frequently fatal in susceptible horses, with clinical signs and lesions resulting from selective increased vascular permeability, leading to impairment of the respiratory and circulatory systems. The virus is transmitted by midges (*Culicoides* spp.), resulting in a seasonal incidence in temperate climates.

Zebras and elephants in enzootic areas have a high prevalence of antibodies, but are not usually clinically infected. Zebras may be important epidemiologically. Rhinoceros may possibly be infected subclinically, but antibody prevalence appears to be low. Dogs may be infected.

African swine fever

African swine fever is a highly contagious, generalised arboviral disease of pigs. No other mammals are affected. It is transmitted by direct contact, inanimate objects and ticks. The virus is very resistant to inactivation. The acute form of the disease is characterised by pronounced haemorrhage of internal organs and a mortality of up to 100% in infected herds. Milder forms of the disease also occur.

19 www.oie.int/animal-health-in-the-world
20 www.wildlifehealthaustralia.com.au/FactSheets.aspx
21 www.animalhealthaustralia.com.au/programs/adsp/nahis/ahia.cfm

The disease occurs as clinical disease in the European wild boar and subclinically in warthogs, bush pigs and giant forest hogs.

Anthrax

Anthrax is an acute infectious bacterial disease that can affect humans and a wide range of domestic and nondomestic animals. Ruminants are the most susceptible, but all mammals are susceptible to some degree. The clinical form may be peracute (death within a few hours of onset of clinical signs), acute (death 24 hours to a few days after onset), or subacute or localised (disease lasts several days and may result in recovery). Anthrax in Australia is confined to certain regions and occurs rarely.

Most warm-blooded animals are susceptible, including domestic ruminants, horses, deer, pigs, camels, dogs, cats and raptors. Anthrax has been reported in macropods overseas, but not in Australia.

Aujeszky's disease

Also known as pseudorabies, Aujeszky's disease is caused by a herpesvirus that infects the nervous system and other organs, including the respiratory tract, in virtually all mammals except humans and other apes. It is primarily associated with swine, which may remain latently infected following clinical recovery. Sporadic cases have been seen in domestic ruminants, deer, dogs, cats, mink, foxes, raccoons and some rodents.

Australian bat lyssavirus

Australian bat lyssavirus (ABLV) is closely related to European bat lyssavirus and classical rabies virus. ABLV infection has been detected in four species of flying fox and one species of insectivorous bat in Australia. These bats are believed to be the primary reservoir for the virus. Serological evidence indicates that all Australian bat species are potentially susceptible to ABLV.

ABLV is transmissible to humans directly from bats, without an intermediate host, and is fatal in humans. The rabies vaccine and immunoglobulin offer effective prophylactic and therapeutic protection from ABLV infection.

Occasional transmission of ABLV to other mammalian species is likely. Transmission of ABLV to individual animals of other species is unlikely to result in the establishment of persistent cycles in these species. Little is known about the host range and pathogenicity of ABLV in mammals other than bats and humans.

Avian influenza

See Section 3.7 for a description of avian influenza.

Bluetongue

An orbiviral disease of ruminants, bluetongue is transmitted only by specific species of biting midges (*Culicoides* spp.). Sheep are the most severely affected; the disease is characterised by inflammation of the mucous membranes, widespread haemorrhages and oedema. Australia's commercial flocks and herds of susceptible

species remain free from naturally occurring disease, despite the presence in Australia of some viral serotypes that are known to be pathogenic. Bluetongue virus has been detected in far northern, northern and eastern Australia. Refer to the National Arbovirus Monitoring Program[22] for further information.

Buffalo, antelopes, camels and deer are also susceptible to bluetongue.

Borna disease

Borna disease is a neurological disease caused by the Borna disease virus. Horses and sheep are the main natural hosts, but occasional cases of Borna disease may occur in any warm-blooded animal. Avian Borna disease virus has recently been reported as the putative cause of proventricular dilatation disease of psittacines.

Brucellosis

Bovine brucellosis is a chronic infectious disease of cattle caused by the intracellular bacterium *Brucella abortus*. Infection results in abortion, stillbirth, infertility and reduced milk production. The disease was eradicated in Australia by 1989.

Globally, other *Brucella* species infect pigs, sheep, goats, dogs, marine mammals and rodents. Cross-infection of cattle by these species is usually limited to a single animal, but the pig bacterium *B. suis* has become established in cattle in South America. Humans, buffalo, sheep, deer and rodents may be susceptible.

Classical swine fever (hog cholera)

Classical swine fever is a highly contagious and usually fatal viral disease, which is capable of spreading rapidly in susceptible pig populations. Strains of the virus of lower virulence cause subacute and chronic forms of the disease. The pig (including wild pigs) is the only natural host.

Contagious bovine pleuropneumonia

Contagious bovine pleuropneumonia is a contagious bacterial disease that afflicts the lungs of affected animals. Cattle are the main hosts, but the disease has also been recorded in buffalo, yak, bison, reindeer and antelope.

Contagious equine metritis

Contagious equine metritis is a sexually transmitted disease of horses that causes endometritis (inflammation of the lining of the uterus) and temporary infertility in mares. It is sometimes associated with cervicitis, vaginitis and, rarely, abortion. Both sexes can be inapparent carriers of the disease bacterium *Taylorella equigenitalis*, strains of which vary in pathogenicity. The disease can be spread mechanically by contact with infectious discharges and contaminated fomites. All breeds of horses are susceptible, and donkeys can be infected experimentally.

[22] www.animalhealthaustralia.com.au/programs/disease-surveillance/national-arbovirus-monitoring-program

Equine influenza

Equine influenza is an acute respiratory viral disease that may cause rapidly spreading outbreaks in congregated horses. It is caused by two members of the genus *Influenzavirus*. Other equines are susceptible, but the disease is seen mainly in horses. Direct contact is required to spread the disease, and the virus retains infectivity in the environment for only a few days. Whether other perissodactyls may carry and spread infection is not known.

Equine piroplasmosis

Equine piroplasmosis (equine babesiosis) occurs in horses, donkeys and mules. Zebras are also susceptible to the causative organism, *Babesia equi*, and act as an important reservoir of infection in Africa.

Equine viral encephalomyelitis — eastern (EEE), western (WEE) and Venezuelan (VEE)

With respect to clinical disease, horses and humans are the most important natural hosts for each of these viruses. Donkeys and mules are as susceptible as horses. EEE virus has caused mortalities in domestic pheasants in the United States. WEE virus very occasionally causes clinical encephalitis in pigs. Each of the viruses infects a wide range of mammalian and bird species. Such infections are subclinical, but some are of epidemiological significance.

Foot-and-mouth disease[23]

See Section 3.7 for a description of FMD.

Glanders

Glanders is a zoonotic infection caused by the bacterium *Burkholderia mallei*. Lesions may have a nasal, pulmonary or cutaneous focus, and disease may be acute (often resulting in death) or chronic. The main hosts are horses, mules and donkeys. Occasional cases occur in humans and small carnivores.

Heartwater

Heartwater is caused by the rickettsial organism *Ehrlichia ruminantium* (formerly *Cowdria ruminantium).* It is transmitted by *Amblyomma* ticks. Peracute and acute forms may cause high mortality. Subacute forms may have a protracted clinical course. Gastrointestinal, respiratory and neurological signs may be seen. Cattle, water buffalo, sheep, goats and many species of wild ruminants, including antelope and African buffalo, are natural hosts.

Hendra and Nipah virus infection

Hendra and Nipah viruses are members of the *Henipavirus* genus of the family *Paramyxoviridae*. Hendra virus is naturally harboured by pteropid fruit bats (flying foxes). Horses are the only species known to have been infected naturally from flying foxes. Humans may acquire disease after close contact with secretions and

[23] The vesicular diseases (foot-and-mouth disease, vesicular stomatitis, vesicular exanthema and swine vesicular disease) all have similar clinical syndromes. Most affect more than one species. Differential diagnosis is therefore important in determining the appropriate response in an outbreak of disease.

body fluids from infected horses. It is safest to assume that nondomestic equids may be susceptible to Hendra virus infection.

Nipah virus has not been detected in Australia. It is a serious viral disease of pigs and humans, with a high case-fatality rate. Flying foxes are the natural hosts. Nipah virus appears to be easily transmitted between pigs by aerosol, and may be transmitted from pigs to other animals. Other animals, including horses, cats, dogs and goats, have been infected with Nipah virus. Means of spread from the natural host to pigs is unknown.

Japanese encephalitis

Japanese encephalitis is an acute mosquito-borne flaviviral disease of humans and other animals, mainly pigs and horses, which occurs throughout much of Asia. Infection causes abortion, fetal abnormalities and encephalitis in pigs, and fever and encephalitis with deaths in horses and humans. Inapparent infections occur in cattle, sheep, goats, dogs, cats, rodents, snakes and frogs.

Herons and egrets are the main reservoir for spreading the virus and, together with pigs, are important amplifying hosts. Several species of bats are susceptible to the virus, and recent work suggests that flying foxes may play a role in virus dispersal. The susceptibility of other native fauna is not known, but they may prove to be significant hosts.

Lumpy skin disease

Lumpy skin disease is an acute, highly infectious, generalised viral skin disease of cattle. It is caused by a capripoxvirus that is similar to the virus that causes sheep and goat pox. It is characterised by fever, ocular and nasal discharges, eruption of cutaneous nodules, swelling of lymph nodes and limb oedema. Biting flies and mosquitoes are thought to transmit the virus mechanically.

Cattle are the only livestock species affected. Giraffe are highly susceptible. Antibodies have been found in buffalo in Africa, and a low prevalence of serological reactors has been found in some antelope species.

Newcastle disease

See Section 3.7 for a description of Newcastle disease.

Peste des petits ruminants

Peste des petits ruminants in sheep and goats resembles rinderpest of cattle and is caused by a closely related morbillivirus. It results in high morbidity and mortality and is more severe in goats than in sheep. Deer have become infected during natural outbreaks. Other nondomestic artiodactylids are either not susceptible or are only subclinically infected and apparently play no part in the epidemiology of the disease.

Porcine reproductive and respiratory syndrome

Porcine reproductive and respiratory syndrome is caused by an RNA virus. Infected pig herds experience late-term abortions and stillbirths, weakness, reduced fertility, severe respiratory disease, high mortality among suckling and weaned pigs, deaths, and a delayed return to oestrus among sows. However, some infected herds show no symptoms. There is some evidence that ducks can be

infected under experimental conditions, but waterfowl are not considered to play any role in natural disease spread.

Rabies

Rabies is an almost invariably fatal viral encephalitis affecting all warm-blooded animals, including humans. It has a long and variable incubation and is transmitted by the bite of a rabid animal. The main reservoir species include members of the canids (dogs, foxes, jackals, wolves), mustelids (skunks, martens, weasels, stoats), viverrids (mongooses, meerkats), procyonids (raccoons) and chiroptera (bats). Many other species are susceptible to spillover events.

Rift Valley fever

Rift Valley fever is a mosquito-borne viral disease affecting a wide range of vertebrate hosts. Mosquitoes are believed to maintain the virus, which can remain in dormant mosquito eggs for several years. The disease is characterised by a high rate of abortion and a high rate of mortality in young animals. Severe disease can occur in humans, so special safety precautions are required.

Cattle, sheep, goats and humans are the major species affected. Camels are also major hosts, and monkeys, rodents, dogs and cats are all susceptible.

Screw-worm fly

The screw-worm fly (SWF) is a member of the blowfly family, and its larvae are obligate parasites on warm-blooded animals. There are two species of concern: *Chrysomya bezziana* (Old World SWF) and *Cochliomyia hominivorax* (New World SWF). The larvae feed on living tissues and associated fluids in open wounds, causing myiasis (the parasitism of animal tissues by blowfly larvae), which results in debility and some deaths. The flies prefer warm, moist conditions with temperatures of 16–30 °C.

All warm-blooded animals, including humans, are susceptible to infestation. Screw-worm myiasis is rarely seen in birds.

Sheep pox and goat pox

Sheep pox and goat pox are highly contagious viral diseases, often with a high mortality rate. They are caused by members of the *Capripoxvirus* genus. Sheep pox and goat pox are generally specific to sheep and goats, respectively, but strains from some areas have been reported to affect both species. The viruses are very resistant to inactivation in the environment, and insects may be involved in their spread.

Swine vesicular disease[24]

Swine vesicular disease is an acute, highly contagious viral disease of pigs caused by a virus of the family *Picornaviridae*. The disease is characterised by fever and lameness, with vesicles on the feet, lower limbs and snout. It is clinically

[24] The vesicular diseases (foot-and-mouth disease, vesicular stomatitis, vesicular exanthema and swine vesicular disease) all have similar clinical syndromes. Most affect more than one species. Differential diagnosis is therefore important in determining the appropriate response in an outbreak of disease.

indistinguishable from FMD. The virus is highly resistant to inactivation. Pigs are mainly infected by ingestion of infected feedstuff, direct contact with infected pigs or contact with contaminated surfaces.

Theileriosis — East Coast fever and Mediterranean theileriosis

Theileriae are obligate intracellular protozoan parasites that infect both wild and domestic Bovidae throughout much of the world. Some species also infect small ruminants. They are transmitted by ixodid ticks and can cause up to 100% mortality in susceptible cattle. Clinical signs often begin with swollen, draining lymph nodes and progress to anorexia, and respiratory and neurological signs.

Transmissible gastroenteritis

Transmissible gastroenteritis is an enteric viral disease of pigs, caused by a coronavirus. It results in rapid dehydration, profuse diarrhoea and rapid death in piglets under 3 weeks of age. The disease only occurs in pigs, although dogs, cats and foxes may be infected and may be a source of infection for pigs. The virus is spread by the faecal–oral route, and starlings have also been implicated as possible mechanical vectors.

Transmissible spongiform encephalopathies

See Section 3.7 for a description of TSEs.

Trichinosis (trichinellosis)

Trichinosis is a parasitic disease caused by the roundworm *Trichinella spiralis*, which is spread by consumption of infected meat or meat products. All mammals are susceptible to trichinosis, but infection is most common in omnivores and carnivores. Of the domestic species, pigs are the main host, followed by dogs and cats, although the incidence in horses is increasing. In wild animal species, infestations of bears, walruses, wild pigs, foxes, rats and mice are of epidemiological significance. Clinical signs are rarely detected in infected animals. Humans are quite susceptible.

Trypanosomiasis, including surra

The tsetse–borne trypanosomiasis diseases (also known as nagana) include infection by *Trypanosoma brucei*, *T. congolense* and *T. vivax*. All will infect a range of mammalian species, some of which may be important carriers, but cause disease mainly in cattle. *T. vivax* may be transmitted by other biting flies (*Stomoxys* and tabanids) and is therefore the only disease likely to be of concern in Australia. *T. simiae* is also tsetse transmitted but causes disease mainly in pigs and, to a lesser extent, sheep.

Dourine is a venereally transmitted disease of equids caused by *T. equiperdum*.

Surra affects many animal species, but is most important in camels and horses. It is caused by *T. evansi* and is transmitted by biting flies.

Chagas disease, caused by *T. cruzi*, occurs in humans and in most domestic animals, particularly dogs, cats and pigs. *T. cruzi* also infects many wildlife species. Important reservoir species include opossums, armadillos (in South America) and wood rats and raccoons (in North America).

Tuberculosis

See Section 3.7 for a description of tuberculosis.

Vesicular exanthema[25]

Vesicular exanthema (VE) is an acute disease of pigs characterised by vesicles on the snout, in the mouth and on the feet. Clinically, VE is indistinguishable from FMD. The VE virus is closely related to a family of viruses that are isolated from marine animals (San Miguel sea lion virus). Disease in pigs has been associated with the feeding of contaminated food scraps containing marine animal product. The pig is the only terrestrial mammal in which VE has been observed under natural conditions. VE only occurs in California and has been eradicated from the rest of the world.

Vesicular stomatitis[24]

Vesicular stomatitis is a viral disease, principally of cattle, horses and pigs. Sheep and goats are resistant and rarely become infected. Vesicular stomatitis can cause signs indistinguishable from FMD, except that horses are infected. The disease has only been seen in North, Central and South America. The epidemiology of the disease is still unclear, but transmission cycles between insects and small wild ruminants are known to occur.

A wide range of other species may be susceptible, including New World species of wildlife (deer, raccoons, monkeys, sloths, rodents and bats). Human infections can occur, resulting in an influenza-like disease.

[25] The vesicular diseases (foot-and-mouth disease, vesicular stomatitis, vesicular exanthema and swine vesicular disease) all have similar clinical syndromes. Most affect more than one species. Differential diagnosis is therefore important in determining the appropriate response in an outbreak of disease.

Appendix 3 State and territory authorities that regulate the Australian zoo industry

State or territory	Regulatory authority for zoos holding exotic species and native species	Regulatory authority for zoos holding only native species
Australian Capital Territory	Territory and Municipal Services Environment and Sustainable Development Directorate	Territory and Municipal Services Environment and Sustainable Development Directorate
New South Wales	Department of Primary Industries	Department of Primary Industries
Northern Territory	Parks and Wildlife Commission	Parks and Wildlife Commission
Queensland	Department of Agriculture, Fisheries and Forestry	Department of Agriculture, Fisheries and Forestry
South Australia	Primary Industries and Regions	
Tasmania	Department of Primary Industries, Parks, Water and Environment	Department of Primary Industries, Parks, Water and Environment
Victoria	Department of Environment and Primary Industries	Department of Environment and Primary Industries
Western Australia	Department of Agriculture and Food	Department of Environment and Conservation

Appendix 4 Legislation relevant to the zoo industry

Authority	Name	Relevance
Commonwealth	*Agricultural and Veterinary Chemicals Code Act 1994*	Control of agricultural and veterinary chemical products
	Environment Protection and Biodiversity Conservation Act 1999	Protection of environment and conservation of biodiversity. Includes a 'List of specimens taken to be suitable for live import ('Live Animal Import List')
	Exotic Animal Disease Control Act 1989 *Exotic Animal Disease Control Amendment Act 1995*	Prevention and control of outbreaks of animal diseases
	Quarantine Act 1908 (currently under review)	Control of importation of animals, plants and products into Australia
Australian Capital Territory	*Animal Diseases Act 2005*	Prevention and control of outbreaks of animal diseases
	Animal Welfare Act 1992	Trapping, handling and destruction of animals
	Environment Protection Act 1997	Use of hazardous substances, coordination of environment protection
	Firearms Act 1996 Firearms Regulation 2008	Possession and use of firearms
	Medicines, Poisons and Therapeutic Goods Act 2008	Use of poisons
	Nature Conservation Act 1980	Conservation of native flora and fauna
	Pest Plants and Animals Act 2005	Pest animal management
	Work Health and Safety Act 2011	Secure health, safety and welfare of employees at work
New South Wales	*Animal Diseases (Emergency Outbreaks) Act 1991*	Control of outbreaks of animal diseases
	Deer Act 2006	Regulation of deer ownership
	Exhibited Animals Protection Act 1986	Includes standardised parameters for zoo exhibit size, etc. Although only legislated in NSW, these standards are often used by other states and territories as benchmarks
	Firearms Act 1996 Firearms Regulation 2006	Possession and use of firearms
	Game and Feral Animal Control Act 2002	Hunting of game animals and some pest species on public land
	National Parks and Wildlife Act 1974	Pest animal management on public land, non-native liberation
	Occupational Health and Safety Act 2000	Safe working environment
	Pesticides Act 1999	Use of pesticides and poisons

Authority	Name	Relevance
	Prevention of Cruelty to Animals Act 1979	Trapping, handling and destruction of animals
	Rural Lands Protection Act 1998 *Rural Lands Protection Amendment Act 2008*	Pest animal management on private and agricultural land
	State Emergency and Rescue Management Act 1989	Emergency management
	Stock Medicines Act 1989	Supply and use of stock medicines
	Stock Diseases Act 1923	Management of disease in stock
	Threatened Species Conservation Act 1995	Native flora and fauna conservation
	Wild Dog Destruction Act 1921 Wild Dog Destruction Regulation 2009	Wild dog management in Western Division only
Northern Territory	*Agricultural and Veterinary Chemicals (Control of Use) Act 2004*	Sale, use and application of chemical products
	Animal Welfare Act	Trapping, handling and destruction of animals
	Disasters Act	Emergency management
	Firearms Act	Possession and use of firearms
	Livestock Act 2008	Detection, prevention and control of stock diseases
	Poisons and Dangerous Drugs Act	Supply and use of poisons
	Territory Parks and Wildlife Conservation Act 1998	Feral animal management, use of pesticides
	Work Health and Safety (National Uniform Legislation) Act 2011	Health and safety of workers
Queensland	*Animal Care and Protection Act 2001*	Trapping, handling and destruction of animals
	Disaster Management Act 2003	Emergency management
	Exotic Diseases in Animals Act 1981	Control of animal diseases
	Health Act 1937 Health (Drugs and Poisons) Regulation 1996	Supply and use of poisons
	Land Protection (Pest and Stock Route Management) Act 2002	Pest animal management
	Nature Conservation Act 1992	Conservation of nature
	Pest Management Act 2001	Protection of public health from pest control and fumigation activities
	Stock Act 1915	Stock disease management
	Weapons Act 1990	Possession and use of weapons, including firearms
	Work Health and Safety Act 2011	Protection in the workplace

Authority	Name	Relevance
South Australia	*Animal Welfare Act 1985*	Trapping and destruction of animals
	Controlled Substances Act 1984 Controlled Substances (Poisons) Regulations 2001	Sale and use of poisons
	Dog Fence Act 1946	Wild dog management
	Emergency Management Act 2004	Emergency management
	Firearms Act 1977	Possession, use and sale of firearms
	Livestock Act 1997	Livestock matters, including exotic disease control
	National Parks and Wildlife Act 1972	Conservation of wildlife
	Natural Resources Management Act 2004	Pest animal management
	Work Health and Safety Act 2012	Health, safety and welfare of workers
Tasmania	*Animal Health Act 1995*	Prevention, detection and control of animal diseases
	Agricultural and Veterinary Chemical (Control of Use) Act 1995	Use and application of agricultural and veterinary chemical products
	Animal Welfare Act 1993	Use of traps and poisons, destruction of animals
	Emergency Management Act 2006	Emergency management
	Firearms Act 1996	Regulation and control of firearms
	National Parks and Reserves Management Act 2002	Protection of national parks and wildlife against introduced species and diseases
	Nature Conservation Act 2002	Protection and conservation of native flora and fauna
	Poisons Act 1971	Sale, supply and use of poisons
	Police Offences Act 1935	Illegal use of poisons
	Vermin Control Act 2000	Pest animal management
	Work Health and Safety (Transitional and Consequential Provisions) Act 2012	Health and safety of workers
Victoria	*Agriculture and Veterinary Chemicals (Control of Use) Act 1992*	Sale and use of poisons
	Catchment and Land Protection Act 1994	Pest animal management on public and private land
	Control of Weapons Act 1990	Use of M44 ejectors
	Drugs, Poisons and Controlled Substances Act 1981	Transportation of baits
	Emergency Management Act 1986	Organisation of emergency management
	Firearms Act 1996	Regulation and use of firearms
	Flora and Fauna Guarantee Act 1988	Management and control of native fauna and flora

Authority	Name	Relevance
Victoria *continued*	*Impounding of Livestock Act 1994*	Impounding of livestock and regulation of impounded livestock
	Livestock Disease Control Act 1994	Prevention, monitoring and control of livestock diseases
	National Parks Act 1975	Management of natural environment in designated parks
	Occupational Health and Safety Act 2004	Health, safety and welfare of workers
	Prevention of Cruelty to Animals Act 1986	Trapping, handling and destruction of animals
	Wildlife Act 1975	Wildlife protection and management
Western Australia	*Animal Welfare Act 2002*	Humane handling, and destruction and control techniques
	Biosecurity and Agriculture Management (Repeal and Consequential Provisions) Act 2007	Control of declared pest or disease, use of chemicals
	Biosecurity and Agriculture Management Regulations 2013	Pest animal management, control and prevention on agricultural land; poison and trap use; prevention and control of diseases in livestock
	Exotic Diseases of Animals Act 1993	Prevention and control of exotic diseases
	Firearms Act 1973	Use of firearms
	Health Act 1911 Health (Pesticides) Regulations 2011	Use, storage and transport of certain pesticides
	Occupational Safety and Health Act 1984	Standards of occupational safety and health
	Poisons Act 1964	Sale and use of poisons
	Wildlife Conservation Act 1950	Protection of fauna and flora, illegal use of traps

Also relevant are:

- *Australian Animal Welfare Standards and Guidelines*
  - *Exhibited Animals – General Standards and Guidelines*
  - taxon-specific standards and guidelines for crocodilians, koalas, macropods, ratites and wombats. These will be regulated at a state/territory level
- the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Appendix 5 Valuation and compensation

Policy of the EAD Response Agreement

The *Government and Livestock Industry Cost Sharing Deed in Respect of Emergency Animal Disease Responses* (2001)[26] (EADRA) establishes a mechanism to facilitate rapid responses to certain EADs, and their control and eradication or containment. The agreement provides a cost-sharing framework and stipulates the following:

> An EAD Response Plan developed by the affected jurisdiction must be consistent with relevant AUSVETPLAN Management Manuals and any applicable AUSVETPLAN disease strategy. An EADRP should also be guided by other AUSVETPLAN manuals.
>
> Cost sharing will apply in respect of compensation determined in accordance with the following principles:
>
> - Consistent with the relevant legislation applying in the jurisdiction in question, compensation is to be paid to the owner of:
>
> a) any livestock or property which is destroyed for the purpose of eradication or prevention of the spread of an emergency animal disease;
>
> b) any livestock which an inspector accredited under the applicable legislation in that jurisdiction, who is a veterinary surgeon or who is approved by a CVO, is satisfied has died of the EAD and who has certified to that effect, and who (after due enquiry) is satisfied that there has been no unreasonable delay in reporting the death of the livestock and where the CVO certifies that the livestock would have been compulsorily slaughtered had they not died.
>
> - In the case of livestock, a second payment may become due on the date the property where the livestock were located becomes eligible to be restocked provided the total value of livestock is greater on that date. The compensation payable at this second payment is the difference between the total value of livestock on that date and the amount paid for livestock in (a) and (b) above.
> - In determining the amount of compensation to be paid, no allowance shall be made for loss of profit, loss occasioned by breach of contract, loss of production or any other consequential loss whatsoever.
> - Participants in industries the representative bodies for which are not parties to the EADRA, and the gross value of production (GVP) of which is greater than $20 million, will not be eligible for compensation; industries the GVP of which is less than $20 million may be eligible for compensation.

Also refer to the **Valuation and Compensation Manual**.

[26] www.animalhealthaustralia.com.au/programs/emergency-animal-disease-preparedness/ead-response-agreement

Glossary

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 Australian and state and territory CVOs; the Director of the CSIRO Australian Animal Health Laboratory; the Australian Government Department of Agriculture; the Director of Environmental Biosecurity in the Australian Government Department of the Environment; Animal Health Australia; and the Ministry of Primary Industries, New Zealand. The committee provides advice to the Australian Agriculture Ministers' Forum on animal health matters, focusing on technical issues and regulatory policy (formerly called the Veterinary Committee). *See also* Australian Agriculture Ministers' Forum
Animal products	Meat, meat products and other products of animal origin (eg eggs, milk) for human consumption or for use in animal feedstuff.
Arbovirus	*Ar*thropod-*bo*rne *virus*. The virus replicates in an arthropod and is transmitted by bite to a vertebrate host in which it also replicates.
At-risk premises (ARP)	A premises in a restricted area that contains a susceptible animal(s) but is not considered at the time of designation to be an infected premises, dangerous contact premises, dangerous contact processing facility, suspect premises or trace premises.
Australian Agriculture Ministers' Forum (AGMIN)	The forum of Australian national, state and territory and New Zealand ministers of agriculture that sets Australian and New Zealand agricultural policy (formerly the Standing Council on Primary Industries). *See also* Animal Health Committee
Australian Chief Veterinary Officer	The nominated senior veterinarian in the Australian Government Department of Agriculture, Fisheries and Forestry who manages international animal health commitments and the Australian Government's response to an animal disease outbreak. *See also* Chief veterinary officer

AUSVETPLAN	*Aus*tralian *Vet*erinary Emergency *Plan*. 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.
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
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 CVOs, the Director of CSIRO-AAHL, the relevant industries, members of the Australian Government Department of Agriculture, and the Australian CVO or delegate 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 states/territories) 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
Enterprise	*See* Risk enterprise
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.
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 the pathogen into the 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.
Job card	A written list of tasks to be carried out by an individual or group as part of an emergency response.
Local control centre (LCC)	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 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 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/international-standard-setting/terrestrial-code/access-online
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: www.oie.int/international-standard-setting/terrestrial-manual/access-online
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).
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, dangerous contact premises, dangerous contact processing facility, suspect premises or trace premises.
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.
Quarantine	Legal restrictions imposed on a place or a tract of land by the serving of a notice limiting access or egress of specified animals, persons or things.
Rehabilitation	Process of adjustment to circumstances prevailing in the aftermath of an emergency disease outbreak. *See also* Wildlife rehabilitation
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, garbage depots.
Salvage	Recovery of some (but not full) market value by treatment and use of products, according to disease circumstances.

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).
Slaughter	The humane killing of an animal for meat for human consumption.
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 (SCC)	The emergency operations centre that directs the disease control operations to be undertaken in that 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).
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, persons 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.
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

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, nonindigenous zoo animals such as rhinoceros).
Wildlife rehabilitation	The process of removing from the wild and caring for injured, orphaned or sick wild animals. The goal of wildlife rehabilitation is to provide food, housing and medical care of these animals, followed by returning them to the wild.
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, in order to facilitate disease control and/or trade.
Zoo	Includes fauna parks, wildlife parks and other facilities housing nondomestic animals.
Zoo collection animal	All animals that form part of the permanent collection of the zoo.
Zoonosis	A disease of animals that can be transmitted to humans.

Abbreviations

AI	avian influenza
AUSVETPLAN	Australian Veterinary Emergency Plan
CA	control area
CCEAD	Consultative Committee on Emergency Animal Diseases
CVO	chief veterinary officer
DCP	dangerous contact premises
DCPF	dangerous contact processing facility
EAD	emergency animal disease
EADRA	*Government and Livestock Industry Cost Sharing Deed in Respect of Emergency Animal Disease Responses* (EAD Response Agreement)
EI	equine influenza
FMD	foot-and-mouth disease
ILO	industry liaison officer
IP	infected premises
LCC	local control centre
NMG	national management group
OIE	World Organisation for Animal Health
RA	restricted area
SOP	standard operating procedure
SP	suspect premises
TP	trace premises
ZAA	Zoo and Aquarium Association
ZMO	zoo media officer

References

Geering WA, Forman AJ and Nunn MJ (1995). *Exotic Diseases of Animals: a Field Guide for Australian Veterinarians,* Bureau of Resource Sciences, Department of Primary Industries and Energy, Australian Government Publishing Service, Canberra.

Vertebrate Pest Committee (2014). *Guidelines for the Import, Movement and Keeping of Non-indigenous Vertebrates in Australia*, Australian Government Department of Agriculture, Canberra. www.feral.org.au/wp-content/uploads/2014/07/VPCGuidelinesJan14.pdf

Reiss AE and Woods RW (eds) (2011). *National Zoo Biosecurity Manual*, Australian Government Department of Agriculture, Fisheries and Forestry; Australian Wildlife Health Network; and Zoo and Aquarium Association. www.daff.gov.au/__data/assets/pdf_file/0003/2026677/national-zoo-biosecurity-manual.pdf