The Ministry of Natural Resources in Ontario, Canada, has managed a rabies control program that has been very successful in eliminating fox rabies from many areas with the use of vaccine baits.[12]

Vaccination will markedly reduce the frequency of rabies in maintenance and spillover hosts. In maintenance hosts, immunisation coverage of more than 50% of the population will result in a significant decline. Immunisation coverage of more than 70% should lead to the eventual eradication of the disease. For dogs, a total population vaccination level of 80% is desirable (WHO 2007). Injectable vaccines have played a major role in eradicating dog biotypes in Europe, North America and Japan, and reducing their frequency in many other regions. Oral vaccines, placed into baits, have reduced or eradicated wildlife rabies over large areas of Europe and North America.

Although rabies vaccination campaigns using oral vaccines have been successful in European and North American wildlife populations, oral vaccination of domestic dog populations has not progressed beyond field experimental stages. Dog rabies is predominantly a problem of resource-poor countries. Although oral vaccination may allow the effective immunisation of a proportion of dogs that cannot easily be caught, these campaigns require significant resources. In addition, the use of live vaccines in companion animals is not well supported. This is due to the small risk of the pet acquiring vaccination-induced rabies, which could potentially be transmitted to humans — an impediment to its ready adoption.

Detailed guidelines for oral vaccination programs are available at the WHO website (WHO 2007).

Overseas protocols for oral vaccination of foxes would be expected to be applicable in the Australian situation. Experimental field protocols that have demonstrated the potential for oral vaccination of dogs may be applicable in some circumstances in Australia. However, the safety and efficacy of bait administration in native Australian species has not been assessed, and WHO recommends that a risk assessment be undertaken before the release of vaccine bait into the environment.

Trap–vaccinate–release

Trap–vaccinate–release (TVR) involves capturing live wildlife with cage traps and vaccinating by intramuscular injection. It has been used for rabies management in urban skunks and raccoons in North America. This method could be used to conserve endangered species. It could also be used to manage rabies in wildlife that live in areas inhabited by people where population-reduction methods and oral-baiting methods are unsuitable or unacceptable to the public, or where satisfactory baits have not been developed. TVR may be preferrable to depopulation in some species, as the latter causes a population sink into which infected or susceptible animals migrate (see 'Population reduction', below).

[12] www.mnr.gov.on.ca/en/Business/Rabies

Population reduction

Widespread, sustained population reduction of animal reservoirs (eg by shooting, gassing, poisoning) to eliminate rabies is not justified for epidemiological, ecologic, economic and ethical reasons (Rupprecht et al 1995).

Maintenance hosts of rabies have high potential rates of population replacement. Even in the face of heavily sustained population removal, they are able to replace population losses at a sufficient rate to maintain rabies virus cycles. Paradoxically, unless it is very heavy, host depopulation can be counterproductive. By removing mature, socially stable animals, depopulation leads to dispersal and a younger demographic structure. This results in higher host-contact rates and greater potential to spread disease.

Nevertheless, some degree of population management is necessary, particularly with companion animal species. Stray and nuisance dogs and cats should be impounded and, if necessary, destroyed. Such policy is important at all times, but particularly during a rabies epidemic.

1.6 Epidemiology

In dogs and other maintenance hosts, outbreaks of rabies occur in local, explosive epidemics of particular biotypes that last for several months. After the main epidemic in a particular area (involving a discrete group of animals) has passed, the outbreak will tail off before becoming locally extinct. However, it may take several years before extinction and occasional cases of disease may still occur during this time. The population then becomes susceptible to reinfection. If sufficiently isolated, local host populations may remain free from rabies for long periods before the next epidemic is initiated.

Maintenance hosts are able to establish dense populations and have high potential-replacement rates. In intense epidemics, the disease itself becomes the major factor controlling host population size. A significant proportion of the maintenance host population is affected and the population density falls, often catastrophically. The transmission ratio falls below the threshold of sustainability and the disease dies down, allowing the host density to recover to its pre-epidemic level. Variation in the relationships and contact between different local populations will increase the chance that there is always at least one infected local population to sustain the disease over the long term.

In cattle, sheep and other herbivores, spillover cases of rabies coincide with rabies in a maintenance host. There are often several nearly simultaneous cases in cattle and sheep herds, resulting from multiple attacks by a rabid animal. However, it is possible that limited transmission between animals in a herd may occur through grooming and drinking from the same water trough. Cattle appear to be highly sensitive to rabies, as its incidence is high in cattle where the disease is present in a maintenance host. This may be due partially to their innate curiosity, which would draw them towards rabid animals.

Ecological factors are critical in determining the epidemiology in the different host species. Dog biotypes are dominant in human societies, both urban and rural, that do not place restricted movement on the dog population. Conversely, in societies that confine dogs to yards and homes, dog rabies is likely to be reduced. The most effective wildlife maintenance hosts establish dense populations, have high

potential replacement rates, and have adapted well to urbanisation and habitat pressure.

1.6.1 Incubation period

The incubation period in animals, including humans, is highly variable. It is generally 3–8 weeks, but can vary from 2 days to 6 months or even longer — up to 6.5 years in humans (Bek et al 1992). Incubation periods in excess of one year have been documented in animals, but rarely so. The OIE *Terrestrial Animal Health Code* gives a maximum incubation period, for regulatory purposes, of 6 months.

Several factors influence the duration of the incubation period, including the virus strain, the virus dose, the distance of the bite site from the central nervous system and the richness of the sensory innervation at the site of virus entry into the body. The last two of these factors are most important. For example, the incubation period following a bite on the face or muzzle could be expected to be much shorter than that after a bite on the trunk or limbs.

1.6.2 Persistence of agent

General properties and the environment

Rhabdoviruses are bullet-shaped and contain single-stranded, unsegmented RNA, which is complementary to messenger RNA and is enclosed in a nucleocapsid protein complex. Rabies viruses are relatively large and contain lipids; hence they are susceptible to a wide range of disinfectants, including warm soapy water, iodine preparations and detergents (see Section 3.2.3, 'First aid').

Rabies virus is comparatively fragile and does not survive for long periods outside the host. The virus is inactivated by heat, and is susceptible to ultraviolet (UV) light, lipid solvents (soapy water, ether, chloroform, acetone), 45–75% ethanol, quaternary ammonium compounds (eg 0.2% cetrimide) and 5–7% iodine preparations. However, the rate of inactivation of rabies virus by physical and chemical conditions is greatly modified by the stabilising effects of polypeptides and other compounds (Kaplan et al 1966, Michalski et al 1976, Matouch et al 1987, Scott Williams Consulting Pty Ltd 2003).

Some authors have suggested that refrigerated virus or virus preparation at pH 5–10 may remain stable for extended periods. Others have thought that the virus may be inactivated by direct sunlight and UV light, and that the virus is labile to proteolytic enzymes, but no supporting data are provided (Fernandes et al 1963, Swanepoel 1994). Survival of rabies virus in the saliva of dead carcasses is unknown, but continued infectivity for a period postmortem cannot be dismissed, particularly in temperate conditions.

Although aerosol contamination in bat caves is well recognised, there are no studies proving that other routes of environmental contamination play any significant role in transmission of rabies (Gibbons 2002).

Live animals

The virus is shed in saliva from about the time of onset of clinical signs. Virus shedding 1–5 days and up to 13 days before clinical signs appear has been reported. Rabies virus has not been identified in other bodily secretions more than 2 weeks before confirmed infection (Fekadu 1988, Greene and Rupprecht 2006).

It is generally accepted that there is no carrier or latent state for rabies.

1.6.3 Modes of transmission

Live animals

Rabies virus is transmitted by contamination of a fresh wound with virus laden saliva. This is usually from the bite of a rabid animal, but can also result from licking abraded skin or mucous membranes. The virus cannot penetrate intact skin.

Respiratory and oral transmission can also occur, but is considered uncommon. In exceptional circumstances, transmission from mother to suckling young has been reported. For practical purposes, these routes can be ignored in framing control strategies.

Transmission risk in laboratory situations includes splashing onto mucous membranes and aerosol exposure (Gibbons 2002).

Animal carcasses

There is neural spread of virus from the brain to various organs and tissues during the clinical phase of the disease. Therefore, the entire carcass is regarded as potentially contaminated with rabies virus.

Animal products and byproducts

Any products or byproducts from a rabid animal should be regarded as potentially infectious and not permitted into the food chain.

Equipment and personnel

Equipment and personnel are not recognised as significant in the transmission of rabies virus.

Vectors

Transmission of rabies virus by arthropod vectors is not known to occur.

Semen and embryos

No evidence exists for transmission in semen or embryos.

Other modes of transmission

Transmission of rabies by the transplant of the cornea and other organs has occurred in humans (Gibbons 2002).

In several species of mammals, including dogs, cattle, bats and laboratory rodents, rabies has been reported to have been transmitted across the placenta from mother to fetus. This is considered an infrequent mode of transmission.

In two separate incidents, aerosols created during laboratory procedures infected two staff members. One person had been using a blender to homogenise rabid goat brains (Winkler et al 1973), and the other had been spraying live rabies virus in a pharmaceutical manufacturing machine (Tillotson et al 1977).

1.6.4 Factors influencing transmission

The population density of susceptible (ie nonimmunised) maintenance-host species is important for transmission. Epidemics often spread on a slow-moving front; for example, 30–60 km per year in fox rabies in Europe (Toma and Andral 1977). However, this is influenced by migration and seasonal dispersal patterns of the host species. Dog rabies can be rapidly spread to new areas by dogs with furious rabies that have running fits (where they may travel distances of more than 30 km) or by pets moved to new areas by their owners.

Australia has widespread and abundant populations of wildlife and feral animals that are known to be maintenance hosts of rabies in other countries. Carnivore species in Australia that may be potential hosts are the European red fox, the feral cat, the feral dog and the dingo. It is difficult to predict with certainty which wildlife species would be involved in an outbreak in Australia. Although threshold densities needed to maintain rabies vary widely, even within the same species (eg the red fox in Canada and Europe), it is known that Australia has densities of the European red fox that greatly exceed the densities of rabies-infected populations within endemic countries.

1.7 Manner and risk of introduction to Australia

The highest risk for a rabies virus dog biotype to enter Australia is by the illegal entry of an infected animal (eg through smuggling or itinerant yachts). The possibility of a fox biotype entering Australia via a smuggled fox is remote. Other routes of entry – such as an infected dog with a nondog biotype being undiagnosed and entering Australia illegally or through quarantine, followed by transmission back to the maintenance host – are unlikely.

There is negligible risk that human cases of rabies will spread to animals or other people.

2 Principles of control and eradication

2.1 Critical factors assessed in formulating response strategy

2.1.1 Features of the disease

- Rabies is almost invariably fatal in both humans and animals.
- Rabies has a broad host range.
  - There are species-specific biotypes of rabies virus.
  - Hosts that are expected to maintain existing biotypes are present in Australia (eg dogs, red foxes, dingoes).
  - Rabies virus can spill over to other host species (eg humans, livestock, cats).
  - Any animal that has rabies can potentially transmit it to other animals and people.
  - Marsupial susceptibility is unknown.
- Most commonly, clinical disease will be associated with behavioural change (eg friendly dogs become aggressive, wildlife lose fear of people).
  - Clinical signs can be variable and unremarkable.
  - Clinical signs are not diagnostic; laboratory testing is required.
- In an outbreak, rapid laboratory diagnosis is needed and adequate laboratory surge capacity is necessary.
  - Definitive diagnosis requires laboratory examination of the brain, and biotype determination requires DNA sequencing. Biotype knowledge is crucial to control and management. Live animal testing does not exclude a diagnosis of rabies. Diagnosis will usually take a day from the time of receipt at the appropriate diagnostic laboratory. Early cases may go unnoticed in an outbreak.
- Rabies virus is fragile and does not persist in the environment.
- Transmission is most often by transfer of saliva, usually through biting or scratching. Parenteral or mucosal membrane exposure (eg though the eyes, oral mucosa, bites, scratches) is required.

2.1.2 Vaccination

- Vaccination is an effective technique for controlling rabies.
- Availability of vaccine for humans and animals is essential.
  - Safe and effective registered parenteral vaccines for humans and animals are available in Australia.
  - Oral vaccination programs in some species have effectively eradicated or controlled rabies in wildlife overseas.

  - Overseas information suggests that more than 70% of the population needs to be vaccinated to ensure population protection in wildlife.
  - The use of oral vaccine in wild animal management has been considered as an option in Australia; however, safety and efficacy would need to be evaluated, and an emergency-use permit would need to be obtained.
  - The possibility of reversion to virulence of an oral vaccinal strain in Australian animals would also need to be evaluated.
- All persons involved in the operational management of rabies (eg veterinarians, field officers and their staff who may handle animals) should be vaccinated in accordance with the *Australian Immunisation Handbook*, 9th edition (NHMRC 2008). This may delay the involvement of some personnel in a response for days or weeks.
- Rabies-specific occupational health and safety issues must be considered in field operations.

2.1.3 Features of the populations

- Wildlife control expertise is available in Australia.
- Wildlife population reduction programs are not considered effective.
- There would be significant human and social impacts if rabies became established. Public outreach, communications and liaison are paramount.

2.2 Options for control and eradication

In this description of options for the control and eradication of rabies, the following terms are used:

- *Infected animal.* A live animal that develops clinical signs consistent with the disease and is known to have an epidemiological link (eg in a known infected area or area of epidemiological interest).
- *Confirmed case.* A laboratory-confirmed rabies-positive animal.
- *Susceptible animal.* Mammals are susceptible; members of Carnivora and Chiroptera are recognised as significant reservoirs. In Australia, dogs, cats, horses, cattle, sheep, pigs and foxes are important susceptible species. Wildlife and feral species may also be important.
- *Suspect animal.* An animal not known to have been exposed to a disease agent but showing clinical signs requiring differential diagnosis (ie with no epidemiological link to the disease).
- *Dangerous contact animal.* A susceptible animal that has been designated as being exposed to rabies following tracing and epidemiological investigation, and considered highly likely to be infected.
- *Trace animal.* An animal not showing clinical signs, but with an epidemiological link to the disease.

Initially, action should be directed towards preventing human exposure as far as is practicable and taking every possible precaution to reduce the risk to those involved in the handling of infected animals.

Control measures could involve any or all of the following:

- recognising rabies cases in animals as early as possible;
- defining the geographic area of the outbreak;
- seizing, and quarantining or destroying infected animals;
- tracing, seizing, and quarantining or destroying dangerous contact animals;
- controlling zoning and movement over animals, including prohibiting gatherings, sporting and recreational activities involving animals (eg an embargo on hunting dogs, and mustering that uses working dogs);
- muzzling all domestic dogs when in public to minimise the risk of transmission;
- vaccinating key populations (eg guide dogs, police dogs) early in the response;
- alerting all veterinary practices, state and territory health departments, wildlife carers, the RSPCA, animal shelters, local government animal control organisations, feral animal control organisations and other relevant stakeholder groups;
- controlling stray animals; and seizing, and detaining or destroying animals not properly controlled or vaccinated;
- vaccinating individual animals and using oral vaccinations (eg through baiting) for large populations;
- identifying vaccinated animals;
- detecting and managing the disease in wildlife;
- mounting publicity campaigns;
- reporting human exposure to possibly infected animals; and
- identifying and assessing trace animals.

Note: Population control (through culling or stamping out) has never been an effective technique in the management of rabies.

The policy to be implemented is described in Section 3.

3 Policy and rationale

For the purposes of an emergency disease response, a case of rabies is one that is confirmed by any of the tests listed in Table 1.3 and gene sequence analysis indicating that the agent belongs to a lyssavirus genotype 1 lineage that is known to be a terrestrial mammal or bat biotype (see Table 1.1).

3.1 Introduction

Summary of policy

Rabies is a notifiable disease in all states and territories of Australia, and is listed by the World Organisation for Animal Health (OIE). The detection of rabies in terrestrial (including bat) hosts in Australia would have significant public health and social impacts, particularly if the disease became widespread, or established in stray or wild animal populations. There may also be ecological and conservation concerns.

Rabies is a Category 1 disease under the government-industry Emergency Animal Disease Response Agreement (EADRA) for cost-sharing arrangements. Category 1 diseases are those for which response costs will be borne 100% by governments.

The default policy is to quickly eradicate rabies to prevent spread to domestic and wild animals, and humans through a combination of strategies including:

- ***quarantine and movement controls*** **on susceptible animals in declared areas to minimise the spread of infection;**
- ***destruction of infected animals*** **to remove the most dangerous source of viruses;**
- ***quarantine, vaccination or destruction*** **of exposed animals;**
- ***movement control, vaccination or quarantine*** **of *suspect animals*** **until their rabies status has been clarified;**
- ***vaccination*** **of domesticated carnivores (eg dogs, cats, ferrets), other selected species and targeted animal groups in declared areas to protect animals against infection and reduce exposure of humans;**
- ***monitoring*** **of wild animals and, if disease establishes in those populations, consideration of implementing a vaccination program;**
- ***tracing and surveillance*** **to determine the source and extent of infection, and to provide proof of freedom from the disease;**
- ***linkage and coordination*** **of public health and environmental authorities so that they are co-responders; and**
- ***a public awareness campaign*** **to facilitate public cooperation from animal owners and the community, including other government and nongovernment authorities.**

Successful implementation of the policy will depend on community cooperation and compliance with all control and eradication measures. Advice about immunisation of humans would be provided by public health authorities.

Population reduction of susceptible species is not appropriate.

The chief veterinary officer (CVO) in the state or territory in which the outbreak occurs is responsible for developing an Emergency Animal Disease (EAD) Response Plan for the particular outbreak.

The Consultative Committee on Emergency Animal Diseases (CCEAD), convened for the incident, assesses the response plan drawn up by the affected jurisdiction's CVO for technical soundness and consistency with AUSVETPLAN, and endorses or seeks modifications to it. Overall operational management of the incident rests with the CVO of the affected jurisdiction, with oversight by the CCEAD. Because rabies is a zoonosis, it is essential for human health authorities to be involved in planning and implementing the response.

The National EAD Management Group (NMG), also convened for the specific incident, decides on whether cost sharing will be invoked (following advice from the CCEAD), and manages the national policy and resourcing needs.

For further details, refer to the **Summary Document**.

CVOs of the affected states and territories will implement disease control measures as agreed in the EAD Response Plan and in accordance with relevant legislation. They will make ongoing decisions on follow-up disease-control measures in consultation with the CCEAD and the NMG, based on epidemiological information about the outbreak.

For information on the responsibilities of the state or territory disease control headquarters and local disease control centres, see the **Control Centres Management Manual**.

3.2 Occupational health and safety

3.2.1 Key points

- Every person involved in a rabies eradication program who may come in contact with an infected animal should be immunised against rabies. Procedures for use of vaccine, including storage, dosage and administration, are set out in the *Australian Immunisation Handbook*, 9th edition (the Handbook) (NHMRC 2008). However, as scientific and medical knowledge of rabies and its prevention may change between revisions of the Handbook, advice should be sought from the relevant state health department on the current recommendations.
- Contact between humans and potentially infected animals should be minimised.
- Personnel who have contact with potentially infected animals should always wear appropriate personal protective equipment (PPE).

- If a potential exposure to rabies occurs, first-aid procedures should be undertaken immediately, as detailed in Section 3.2.3. Medical advice should always be sought without delay, irrespective of vaccination status, as postexposure prophylaxis may be needed.

3.2.2 Vaccination

General

Safe and effective vaccines for protecting humans against rabies are available. There are two protocols for rabies vaccination: pre-exposure vaccination and postexposure vaccination. Vaccination recommendations for staff involved in a rabies eradication program may differ from person to person, depending on the potential for exposure to live virus.

In particular, vaccination status of veterinary staff in the declared areas should be determined. Unprotected veterinary staff should be advised of risks and should be advised to seek medical advice regarding vaccination options. Unprotected veterinary staff should not handle suspect animals.

Antibody titres in vaccinated staff are likely to wane with time. It is important that an adequate titre be maintained in staff exposed to potentially rabid animals and in laboratory staff working with live virus. Regular antibody titre measurements or a vaccine booster dose may be required. The specific regimens differ depending on the nature of the potential exposure; these are outlined in the Handbook (NHMRC 2008).

Before engaging in at-risk activities, recently vaccinated people should ensure that they have a protective titre.

Postexposure vaccination

Postexposure prophylaxis (PEP) is used when a person may have been exposed to rabies virus, usually following an animal bite or scratch. PEP varies according to whether or not the person is vaccinated against rabies. For unvaccinated people, PEP includes rabies immunoglobulin. Further information is available in the Handbook (NHMRC 2008).

As rabies may have a long incubation period, medical advice about PEP should be sought regardless of the time that has elapsed since the exposure.

3.2.3 First aid and medical assessment

It is essential that, whenever a potential exposure to rabies virus occurs — via a bite, scratch, or splash onto mucous membranes or aerosol exposure in the laboratory — first aid is commenced as soon as possible to remove the virus from exposed tissue. Medical advice must be sought immediately on the appropriate course of action, irrespective of whether the person has been previously vaccinated against rabies.

Proper cleansing of any wounds, abrasions and splashes is an important first-aid measure in preventing rabies of people. If a person is bitten or scratched, or mucous membranes (eg eyes, nose, mouth or existing wounds) are splashed with any bodily fluids from the animal, the affected area should be immediately and

thoroughly washed with soap and water for approximately 15 minutes. Scrubbing should be avoided, as this may cause abrasions that could facilitate entry of the virus into the wound. A virucidal antiseptic, such as povidone–iodine, iodine tincture, aqueous iodine solution or alcohol (eg ethanol), may be applied to wounds after washing.

3.2.4 Handling of animals

General approach

Suspected rabid animals should be approached and handled only when necessary and only by appropriately trained personnel. Potentially rabid animals should be approached with extreme caution. If it can be done without risk to the operator, every effort should be made to capture and safely confine the animal. If the animal cannot be safely captured or confined, and therefore constitutes a risk to people or other animals, it should be immediately destroyed.

A high level of hygiene and safety measures for personnel are required in the handling of infected and suspect animals. All field and laboratory staff should be trained in the correct use of PPE and in the decontamination of reusable equipment. Contamination with aerosols and saliva is highly possible; therefore, all personnel who are associated with the program, and are handling animals and animal parts must take all necessary precautions. This includes the use of gloves, masks and eye protection.

The medical reasons for rabies pre-exposure and postexposure vaccination should be explained to all staff. They should also be fully conversant with the correct first-aid and medical procedures to be employed after a potential human exposure.

Capture and handling of animals

Nets or dog-catching poles with stout rope or wire loops may be used for small animals, and ropes or other restraints for large animals. Containers, cages or pens must be very strongly constructed and well secured. If a suspect animal is first presented at a veterinary clinic, it should be hospitalised away from other animals. Confined suspect animals should be under veterinary care.

Immediate postexposure first aid of dogs should occur in accordance with first-aid guidelines for people (see Section 3.2.3). When handling an exposed animal, handlers should take due care to minimise any risks to themselves.

Destruction of animals

Animals should be destroyed safely and promptly. When selecting destruction methods, preserving opportunities for sampling for disease should be considered. Destroyed animals, and their excretions and secretions, should be handled with care and while wearing appropriate PPE to avoid potential exposure to live virus through abraded skin or mucous membranes (eg eyes and mouth).

Postmortem examinations and specimen collection

Postmortem examinations and specimen collection in rabies cases pose particular hazards to staff. See Section 1.4.3 for further details.

3.3 Strategy for control and eradication

The default policy is to eradicate the pathogen in animals and to prevent spread of infection to humans.

The control and eradication of an outbreak of rabies will require the collaborative efforts of animal and human health services. Wildlife and other relevant authorities should also be involved in the response.

3.3.1 Stamping out

Destruction of the infected animals (eg maintenance hosts) and dangerous contact animals is necessary because infected animals are the only source of spread. However, the cornerstone of effective response to rabies is vaccination, which will be implemented early in an eradication program.

Although the destruction of some animals may be necessary during rabies control programs, care must be taken in any policy that involves widespread destruction of animals. Experience has shown this to be ineffective, costly and unpopular.

Culling of wild or feral animals may be counterproductive. New animals move into depopulated territories, with concurrent behaviours such as increased fighting and territory protection that can lead to an increased rate of infection. However, population management strategies (eg fertility control, environmental modification) to reduce the carrying capacity may be effective in principle.

3.3.2 Quarantine and movement controls

Infected premises

The infected premises (IP) will be immediately declared and quarantine requirements imposed. The area around the IP will be declared as a restricted area (RA), and movement controls will apply. Infected animals will be destroyed.

Restricted area

The movement of susceptible animals into and within the RA will be controlled under a permit system (see Section 4.2).

A trace animal in an RA will be confined so that there is no contact with other susceptible animals. During confinement, it will be vaccinated and observed until it either demonstrates infection or a titre of more than 0.5 international units (IU)/mL postvaccination.

An animal that is known to have been exposed to rabies and that is considered highly likely to be infected (ie a dangerous contact animal) will not be vaccinated, but will be destroyed.

On a case-by-case basis and only where security can be assured, the CVO may decide, in consultation with the diagnostic team, that a suspect animal (an animal not known to have been exposed to rabies, but showing clinical signs requiring differential diagnosis) may not be immediately destroyed. In such cases, a conservative approach would be taken unless available information indicates otherwise. For example, the animal may be held in quarantine, such as on an

owner's property that has been declared a quarantine premises. Appropriate rabies postexposure treatments for the animal would be carried out. The animal would remain in quarantine until its status is determined – either the clinical signs are clearly not due to rabies and it has an adequate vaccinal titre, or it has rabies. However, the risks must be explained to the owners who are responsible for maintaining quarantine. This premises must be declared under appropriate legislation.

If infection in wildlife is considered likely or has occurred, farm animals – particularly working dogs – will be confined, so that contact with wildlife is minimised. Limitation of contact between other farm animals and wildlife may also be appropriate. Although farm animals, such as cattle and horses, are unlikely to transmit rabies to other animals, there is the possibility that humans handling these animals could be infected. Owners should be advised of the risk.

Animal gatherings will be minimised during the outbreak. However, as animals become protected through vaccination programs and immunity develops, gatherings, such as dog shows, may be approved under permit.

See Section 4 for further details on declared areas, and quarantine and movement controls.

Transmission area

Where wildlife populations may be infected and there is a need to implement specific control measures (eg enhanced surveillance and movement controls), the affected jurisdiction's CVO could declare a transmission area (TA) within the declared RA (see Section 4.1.2).

Control area

A control area (CA) may need to be declared. This would consist of a buffer between the RA and other areas free from any controls.

Movement controls may be less restrictive, and animals in the CA may be subject to a vaccination program.

3.3.3 Tracing and surveillance

The rabies virus biotype will be determined as soon as possible (to determine the likely maintenance host). This information will inform tracing and surveillance.

All animals likely to have been exposed to the infected animal during the previous 14 days will be traced (14 days is considered to be the maximum period of virus excretion before clinical signs). They will undergo risk assessment. Animal management will depend on outcomes of the risk assessment and may include destruction, vaccination or quarantine. Management may include an initial period of observation at home.

Susceptible animals within the RA will need to be surveyed. For domestic animals, this may involve visiting and mapping properties, and determining population densities in the RA. Surveillance will be directed towards the detection of clinical signs because there is no reliable method of excluding infection in live animals. Animal owners will need to be encouraged to report signs. Animals will probably

be vaccinated at property visits; this will encourage owner participation in surveillance programs.

A surveillance program will need to be developed for surveillance of wildlife and feral animals. Surveillance may involve spotlight, ground or aerial surveys. This will result in the capture or destruction of any animals exhibiting abnormal behaviour, and the collection of dead animals for laboratory examination. Because rabies is fatal within days of clinical onset, the number of detectably rabid animals in a wild population is always low.

Veterinary reports of animal exposures to suspect rabid animals will be investigated. Reports of human exposures will be reported to human health authorities. The exposed and suspect animals will be either examined and destroyed for laboratory testing, or placed under observation as considered necessary. Any animal showing a change of behaviour should be given a suspect status.

Surveillance will target the maintenance-host species involved in the outbreak. Any species involved in spillover infection from the host species will be preferentially targeted for surveillance over other species.

A public awareness campaign will also be critical to enlisting the support of the public to report sick and dead animals so that relevant specimens can be obtained. Widespread destruction of animals to obtain surveillance samples is not a recommended approach. Further information about public awareness can be found in Section 3.3.11.

Guidelines for wildlife surveillance are further discussed in the AUSVETPLAN **Wild Animal Response Strategy**.

In the case of an infected imported animal confined in or released from official quarantine, the biotype of the infection will need to be quickly determined, initially by consideration of the country of origin and route of travel. Other animals still in the quarantine facility will remain in quarantine. All animals that have been released during the previous 14 days will be traced and undergo risk assessment. Appropriate management of the animals will be instigated. Management of these animals will depend on the risk assessment and may include destruction, vaccination or an extended quarantine period.

See Appendix 2 for further details on surveillance.

3.3.4 Vaccination

In most situations, vaccination is the cornerstone of any rabies-response program. The vaccination protocol will generally be in accordance with the manufacturer's schedule. Any variation to the vaccination protocol will be at the discretion of the state CVO, in consultation with the CCEAD. The vaccine(s) used will have met appropriate regulatory requirements for use in Australia.

The priority for vaccination is the maintenance-host species (eg foxes). Irrespective of the maintenance-host species, any pets that may be linked to the incident will be considered for vaccination to reduce the exposure to humans. Livestock and horses may be vaccinated if the virus begins to cycle in the wild animal populations and if

adequate supplies of vaccine are available. There may be a special need to protect susceptible zoo animals and other groups of animals.

All vaccinated animals will be identified.

An attempt will be made to vaccinate all targeted animals. Vaccination may occur at central points or by house-to-house vaccination, or by a combination of both.

Oral vaccination

Once it has been established that a particular wildlife species is the maintenance host, an oral vaccination program will need to be developed and implemented for the identified species. This will be based on the most recent information on vaccine types, baiting technology, vaccination strategies, host ecology and other relevant information.

Consideration needs to be given to the cost-effectiveness of different options, the efficacy of vaccines and bait types for the host in question, the safety of the vaccine in humans and other nontarget species (eg endangered native animals), the thermostability of the vaccine and bait, and the socioecological conditions that may influence options for vaccination strategies.

Trap–vaccinate–release

Trap–vaccinate–release (TVR) programs may have to be initiated (see Section 1.5.3). TVR may become the only option where an oral vaccine or an efficient bait has not been developed for a species. TVR can be used with a buffer perimeter zone of oral vaccination.

3.3.5 Treatment of infected animals

The treatment of infected animals is ineffective.

3.3.6 Treatment of animal products and byproducts

Because of the fragility of the virus, treatment is not usually necessary.

3.3.7 Disposal of animal products and byproducts

Products or byproducts from infected animals will not be permitted into the food chain. All products from infected animals will be destroyed. The rabies virus is readily destroyed by heat and normal rendering.

Although there is no evidence for transmission of rabies via semen and embryos, these products collected within 14 days before the onset of clinical signs will need to be considered for destruction.

For occupational health and safety considerations, see Section 3.2.

3.3.8 Decontamination

Housing, examination and postmortem areas, as well as hands and clothing, must be decontaminated regularly and kept clean. During decontamination, a high level of hygiene and safety measures for personnel is required.

Contamination with aerosols and saliva is a possibility. All at-risk personnel must take precautions, such as the use of gloves, suitable respiratory protection (eg a P2 respirator) and eye protection.

For further details, see the AUSVETPLAN **Decontamination Manual.**[13]

3.3.9 Wild animal control

Prevention of contact between wild and domestic animals during an outbreak is important to prevent spread. If the disease is detected in wildlife, the population of interest needs to be defined and included in the RA at the earliest possible time. The main concern will be feral dogs and cats, dingoes, and foxes.

Wildlife experts must be consulted in planning, monitoring, surveillance and control programs. Measures should not be introduced that are likely to disperse wildlife.

The priority is to identify the maintenance host(s), initiate vaccination and, as appropriate, monitor other susceptible species.

The extent of wildlife control areas will be determined on the basis of:

- epidemiological features of the index case;
- biology of the maintenance host(s); and
- known or acquired information on the population densities of susceptible species in the risk areas.

The following methods will be considered to control rabies in wildlife:

- oral vaccination;
- TVR programs;
- limited and cautious use of population reduction after careful consideration of case-by-case circumstances (note that population reduction is considered to be ineffective and may be counterproductive); and
- combinations of the above.

Population reduction

If there has been a decision to reduce wildlife or feral animal populations in the RA, and the outbreak has been detected early, population reduction needs to be managed concurrently with control measures in domestic animals. When developing population-reduction strategies, consideration needs to be given to the potential risks of rabies spread that can be associated with this strategy.

For further information on wildlife-control and baiting techniques, and other procedures, see the AUSVETPLAN **Wild Animal Response Strategy**.[13]

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[13] www.animalhealthaustralia.com.au/aahc/index.cfm?3C1A77F1-00BD-FCC2-2EAF-1808A3DD71FC

3.3.10 Vector control

Control of vectors is not necessary.

3.3.11 Public awareness and media

Declaration of a case of rabies in Australia is likely to lead to public concern. A public awareness and media campaign will be developed early in the response. The Primary Industries National Communication Network will need to be activated, as it will have a major input. Communication messages will need to be clear about the outbreak response strategy. Information should be provided about the public health aspects of rabies, what constitutes a risk, where to obtain advice, reporting of suspect animals, appropriate clinical management of animal-bite cases, the progress of eradication and events of public interest.

Campaigns to educate the public about rabies should be conducted at schools, community centres, health centres, workplaces and other places of mass gatherings, and through the available media. Any campaign should ensure a consistent public message from all relevant authorities.

To assist the response, the public should be encouraged to report any bites from dogs or other animals, stray dogs or unusual behaviour in wild animals. They will also be encouraged to effectively confine their animals. Guidelines on measures to be adopted by the public should be readily available at veterinary and medical clinics. Poor communication messages could lead to ineffective and unnecessary culling of some animals.

The roles and responsibilities of veterinary and medical practitioners, local government, and wildlife and public health authorities should be clearly identified in all communications and made known to all concerned. Veterinary practitioners are required to report all suspect cases of rabies in animals. Local government and public health authorities will be involved in rabies control measures.

All human exposures in the RA must be reported to allow for risk assessment of the person, and tracing, seizure, detention or destruction of the animal involved.

Education campaigns and other information should emphasise the almost invariably fatal course of the disease and the danger of handling rabid animals.

3.4 Funding and compensation

Rabies is classified as a Category 1 disease under the EAD Response Agreement (EADRA).

Category 1 diseases are EADs that predominantly have a serious effect on human health or the environment (eg depletion of native fauna). They may have only minimal direct consequences for the livestock industries. For this category, the

response costs will be borne 100% by governments, with no contribution from livestock industries (refer to the EADRA for details).[14]

Information on the cost-sharing arrangements can be found in the **Summary Document**[15] and in the **Valuation and Compensation Manual**.[16]

[14] Information about the EADRAcan be found at www.animalhealthaustralia.com.au/programs/eadp/eadra.cfm
[15] www.animalhealthaustralia.com.au/programs/eadp/ausvetplan/ausvetplan_home.cfm
[16] www.animalhealthaustralia.com.au/aahc/index.cfm?3C1A77F1-00BD-FCC2-2EAF-1808A3DD71FC

4 Recommended quarantine and movement controls

4.1 Guidelines for classifying declared areas and premises

4.1.1 Declared premises

Infected premises

An infected premises (IP) is a defined area (which may be all or part of a property) in which rabies exists or is believed to exist, or in which the rabies virus exists or is believed to exist.

Dangerous contact premises

A dangerous contact premises (DCP) is a premises that contains a susceptible animal(s) not showing clinical signs that, following a risk assessment, is considered highly likely to contain an infected animal(s) and present an unacceptable risk to the response if not addressed.

Suspect premises

Suspect premises (SP) is a temporary classification of a premises that contains a susceptible animal(s) not known to have been exposed to an infected animal(s), but showing clinical signs that require an investigation(s).

Trace premises

Trace premises (TP) is a temporary classification of a premises that contains a susceptible animal(s) that tracing indicates may have been exposed to an infected animal(s) and that requires an investigation(s).

4.1.2 Declared areas

Restricted area

Following a risk assessment that takes into account the history of animal movements, a restricted area (RA) will be declared. The RA may be as small as an individual IP or sufficiently large to include home ranges of wildlife or feral animals. The RA will be subject to intense surveillance and movement controls. Movement of susceptible animals out of the area will, in general, be prohibited, while movement into the area would only be by permit (see Section 4.2). Multiple RAs may exist within one control area (CA).

The size of the RA will depend on the ecology of the maintenance host(s). The boundary will take into account the distribution and density of susceptible animals.