Newcastle disease

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EMERGENCY ANIMAL DISEASE WATCH HOTLINE: 1800 675 888

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

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Group of chicks.

Chickens are the most susceptible poultry species to Newcastle disease.

1 Introduction

1.1 This manual

1.1.1 Purpose

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

1.1.2 Scope

This response strategy covers ND caused by Newcastle disease virus.

This response strategy provides information about:

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

The key features of ND are described in the **Newcastle disease Fact Sheet** (Appendix 1).

1.1.3 Development

The strategies in this document for the diagnosis and management of an outbreak of ND are based on risk assessment. They are informed by the recommendations in the World Organisation for Animal Health (OIE) *Terrestrial animal health code* (10.9) and the OIE *Manual of diagnostic tests and vaccines for terrestrial animals* (3.3.14). The strategies and policy guidelines are for emergency situations and are not applicable to policies for imported animals or animal products.

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

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

1.2 Other documentation

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

- other AUSVETPLAN documents, including the operational, enterprise and management manuals; and any relevant guidance and resource documents. The complete series of manuals is available on the Animal Health Australia website[1]
- relevant nationally agreed standard operating procedures (NASOPs).[2] These procedures complement AUSVETPLAN and describe in detail specific actions undertaken during a response to an incident. NASOPs have been developed for use by jurisdictions during responses to emergency animal disease (EAD) incidents and emergencies
- relevant jurisdictional or industry policies, response plans, standard operating procedures and work instructions
- relevant Commonwealth and jurisdictional legislation and legal agreements (such as the Emergency Animal Disease Response Agreement – EADRA[3]), where applicable.

1.3 Training resources

EAD preparedness and response arrangements in Australia

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

1 www.animalhealthaustralia.com.au/ausvetplan

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

3 animalhealthaustralia.com.au/eadra

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

2 Nature of the disease

Newcastle disease (ND) is a highly contagious, generalised viral disease of domestic poultry, cage and aviary birds, and wild birds. It is usually seen in domestic gallinaceous birds (poultry) as a rapidly fatal, high-mortality condition characterised by gastrointestinal, respiratory and/or nervous signs. In other avian species, the disease produced by virulent ND viruses ranges clinically from inapparent to a rapidly fatal condition.

Avian paramyxoviruses (of which ND viruses are a subgroup) have varying capability to produce clinical disease (pathogenicity) in domestic chickens, with some virus strains showing high levels of pathogenicity and other strains producing no disease (nonpathogenic or avirulent).

2.1 Aetiology

Viruses that cause Newcastle disease are found within the avian orthoavulavirus 1 (AOAV-1) species, formerly known as avian paramyxovirus 1 (APMV-1). This species represents a single serotype, forming a diverse group of enveloped, single-stranded, nonsegmented RNA viruses.

AOAV-1 viruses vary widely in virulence and in the tissues affected (tissue tropism) and in susceptible birds infection induces a wide range of clinical signs and pathological lesions (Brown & Bevins 2017). On the basis of the speed with which they kill chickens or chicken embryos under defined conditions, and/or the amino acid sequence of the cleavage site of the F0 gene (see below), they are described as:

- velogenic (highly pathogenic, or virulent)
- mesogenic (moderately pathogenic)
- lentogenic (only mildly pathogenic)
- asymptomatic (sub-clinical, enteric).

Section 2.5.2 provides further details on the clinical significance of these classifications.

ND is a listed disease in the World Organisation for Animal Health (OIE) *Terrestrial Animal Health Code*. However, not all AOAV-1 infections are considered to be ND for the purposes of classification as an emergency animal disease. Based on the properties of the virus, the OIE has defined ND as an infection of poultry caused by an ND virus of AOAV-1 that meets one of the following criteria for virulence:

- the virus has an intracerebral pathogenicity index (ICPI) in day-old chicks (*Gallus gallus*) of 0.7 or greater
- multiple basic amino acids have been demonstrated in the virus (either directly or by deduction) at the C-terminus of the F2 protein, and phenylalanine occurs at residue 117, which is the N-terminus of the F1 protein. The term 'multiple basic amino acids' refers to at least three arginine or lysine residues between residues 113 and 116. Failure to demonstrate this characteristic pattern of amino acid residues requires characterisation of the isolated virus by an ICPI test.

In this definition, amino acid residues are numbered from the N-terminus of the amino acid sequence deduced from the nucleotide sequence of the F0 gene; 113–116 corresponds to residues –4 to –1 from the cleavage site.

In Australia, only the second of these two criteria is usually applied (ie classification of ND is based on sequencing of the F0 gene; see Section 2.5.5).

During replication, ND virus is produced with a precursor fusion glycoprotein, F0, which has to be cleaved into F1 and F2 proteins for the virus to become infectious. The prime determinant of pathogenicity in ND virus strains is the possession of basic amino acids at least at positions 113, 115 and 116, and phenylalanine at position 117 of the F0 protein. All but one virulent ND virus (pigeon paramyxovirus — PPMV-1) also has a basic amino acid at position 112. These positions form the cleavage site of the F0 protein; they correspond to the C-terminus (116) of the F2 protein and the N-terminus (117) of the F1 protein. If the F0 protein can be cleaved by proteases that are found in a wide variety of internal organs — including liver, spleen, brain, heart and lymphoid tissues — the virus can replicate in a wide variety of organs. The result is systemic infection and the appearance of clinical signs followed by death in most cases.

For viruses of lower virulence, the F0 protein can only be cleaved by trypsin-like enzymes, which are found only on endodermal surfaces, such as in the intestinal and respiratory tracts. This limits replication to these surfaces in the animal. As a distinguishing feature, these viruses cannot produce plaques in tissue culture without trypsin being added to the overlay medium.

Mutations at the F0 cleavage site of endemic avirulent viruses in Australia gave rise to the highly virulent viruses that were involved in outbreaks of ND in Australia in 1998, 1999, 2000 and 2002. Phylogenetic studies have shown these viruses are very closely related to each other as well as to a virus of low virulence isolated from chickens in the same area. This provides evidence that the virulent viruses emerged by mutation from Australian origin avirulent viruses (Alexander 2001; Gould et al 2001). These outbreaks were classified as Australian-origin ND infection. ND infection that is introduced to Australia from overseas is classified as exotic ND infection.

Australian-origin and exotic ND viruses can be distinguished by the genetic sequence of the F0 and haemagglutinin–neuraminidase (HN) genes, and the length of the HN extension (additional amino acids at the C-terminus of the protein in some strains). In an emergency response, different actions may be taken for Australian-origin and exotic ND, based on possible epidemiological differences between these two scenarios.

2.2 Susceptible species

ND virus is infective for almost all avian species, both domestic and wild. Natural infection has been reported in humans and rodents, and a variety of laboratory animals have been infected experimentally.

Poultry

Chickens, turkeys, ducks and geese are all susceptible to infection with ND virus however chickens are considered to be the most susceptible of domestic poultry species. Outbreaks can occur in turkey flocks but are usually less severe than in chickens. Ducks and geese can be infected and are capable of spreading the virus while showing mild, if any, clinical signs.

Peafowl, guinea fowl, pheasants and quail are all susceptible to natural infection however the disease is usually mild, except for quail which are highly susceptible. Ratites are susceptible to infection but fairly resistant to developing clinical signs.

Parrots are highly susceptible to Newcastle disease.

Other birds

Pigeons are susceptible to infection and often show mild or no signs of clinical disease, even when infected with virulent strains of the virus. However, infection in these species can result in clinical signs similar to those outlined for chickens.

Psittacines are very susceptible to ND virus and nervous signs usually predominate when there is clinical disease (Kaleta et al 1988). Passerine birds are reported to vary in their susceptibility; some species show no signs of disease, while others may develop severe disease (Ayala et al 2019).

Wild water birds can be infected with ND virus that is usually associated with intestinal infection and mild or no clinical signs, thereby acting as a potential reservoir of avirulent ND viruses. Cormorants and gulls have also been shown to carry virulent ND, and have been associated with ND outbreaks in the United States (Diel et al 2012).

At least 250 avian species can be infected with AOAV-1 naturally or experimentally (Wang et al 2015). There may be variation in the severity of clinical signs even within different species of a single avian genus.

2.2.1 Zoonotic potential

Human infection with ND virus is uncommon; most infections have occurred in laboratory workers who handle the virus. Vaccinators, and people who eviscerate and prepare poultry for market may also become infected. Person-to-person transmission of ND virus has not been reported.

Humans exposed to ND virus may suffer headache and flu-like symptoms, and can develop conjunctivitis, which is usually mild and persists for 1–2 days. Occasionally, the conjunctivitis can become quite severe and even lead to some lasting impairment of vision. The incubation period is reported to be 6–7 days. There is no risk to human health from eating infected poultry or poultry products.

2.3 World distribution

For the latest information on the distribution of ND, refer to the OIE World Animal Health Information System.[5]

2.3.1 Distribution outside Australia

ND was first observed on the Indonesian island of Java in 1926. Later that year, it spread to Newcastle in the United Kingdom, where it was first recognised and named as a different disease from fowl plague (highly pathogenic avian influenza). Strains of ND virus are present in most countries.

New Zealand and Papua New Guinea remain free from pathogenic ND viruses. West Papua (formerly Irian Jaya), a province of Indonesia, is the closest area to Australia where virulent ND is endemic. Indonesia, Timor-Leste and Southeast Asia all have endemic virulent ND.

Virulent strains of ND are endemic in a number of countries, including areas of Mexico, Central and South America, many parts of Asia, the Middle East and Africa, and in wild birds in the United States and Canada.

There have been three major panzootics of viscerotropic velogenic ND (see Section 2.4.2) since the disease first came to international attention in 1926 (Alexander 1988). Outbreaks across Europe in the early 1990s, and in the United Kingdom in 1996 and 1997 probably originated from infected migratory birds. The outbreak of ND in the United States during 2002–03 resulted in depopulation of more than 3 million birds and containment costs exceeding US$160 million.

2.3.2 Occurrence in Australia

Virulent ND virus was absent from Australia, following eradication of outbreaks in 1930 and 1932 in Victoria, until an outbreak of Australian-origin ND in New South Wales in 1998.

Avirulent strains are endemic in Australia; the prototype of these strains, designated V4, was identified in Queensland in 1966 and rapidly spread across Australia (Simmons 1967). The virulence of the V4 strain is very low. Since 1966, several avirulent and lentogenic strains have emerged in Australia, including the Peats Ridge virus, which was detected in New South Wales in 1998; it differs at two base pair positions from the parent lentogenic virus. Further mutations in one or more of these precursor strains led to the emergence of virulent ND viruses in 1998–2002 in the Sydney Basin, Mangrove Mountain and Tamworth areas of New South Wales, and Meredith in Victoria.

Since the disease outbreaks of 1998–2002, it is useful to differentiate the source of ND outbreaks between those that have arisen from mutations in Australian lentogenic ND viruses (Australian-origin ND) and outbreaks from incursions of virulent ND viruses of overseas origin (exotic ND).

Following these outbreaks and completion of a national survey of ND virus distribution in late 2000, the National Newcastle Disease Steering Committee was formed, and a National Newcastle Disease Management Plan was put in place. There have been no outbreaks of Australian-origin ND since compulsory vaccination of long-lived birds commenced under the first plan in 2002–03.

The pigeon variant of ND, PPMV-1, was first diagnosed in Victoria in 2011. It is believed to have been introduced by illegal importation of 'fancy' pigeons and has resulted in high mortality in pigeon lofts. In contrast to the experience in Europe and the United States, there have been no reports of disease in commercial poultry in Australia as a result of exposure to PPMV-1.

5 https://wahis.oie.int/#/home

2.4 Epidemiology

2.4.1 Incubation period

The incubation period for ND is usually 2–6 days in domestic fowl, but can be up to 15 days. It is generally shorter for younger birds.

During the incubation period, the virus replicates at the site of introduction. Virulent and mesogenic viruses are then discharged into the bloodstream, where they replicate in the visceral organs. Another release into the bloodstream, about 2 days after infection, coincides with the excretion of virus via the respiratory tract and in the faeces. Clinical signs occur 24 hours later. The clinical signs are determined by the tropism of the virus. Infection with lentogenic viruses remains on the epithelial surfaces.

OIE incubation period

For the purposes of the OIE *Terrestrial Animal Health Code*, the incubation period[6] for ND is 21 days.

2.4.2 Persistence of agent and modes of transmission

Dissemination of virulent ND virus between flocks has been attributed to the following (in descending order of importance):

- movement of infected birds (including vaccinated birds)
- movement of feedstuffs, personnel and equipment
- movement of infected poultry products and byproducts
- contamination of clothing, footwear, equipment, litter, manure and feed with faeces containing ND virus (Utterbuck 1972; Alexander 1988, 1997, 2000a).

Spread of infection within flocks in the New South Wales outbreaks of 1998–2002 was more rapid for birds on litter than for birds in cages.

Transmission studies with Australian-origin ND viruses have demonstrated low transmissibility in the laboratory compared with exotic strains of ND viruses. This suggests that bird, human and fomite movements, and windborne spread of contaminated chicken debris and litter from infected flocks are likely to be the major means of spread of Peats Ridge family viruses and Australian-origin ND viruses.

General properties

Compared with most paramyxoviruses, ND virus is relatively heat stable, a feature of great relevance to its epidemiology and control (Fenner et al 1987):

- ND virus remains infectious in bone marrow and muscles of slaughtered chickens for at least 6 months at –20 °C and for up to 4 months at 4 °C.
- Infectious virus may survive in eggs laid by infected hens for months at room temperature and for more than 1 year at 4 °C.
- ND virus can survive on feathers for 255 days and in litter for 42–53 days.
- ND virus may remain infectious for long periods on contaminated premises.

6 In the OIE Terrestrial Animal Health Code, 'incubation period' means the longest period that elapses between the introduction of the pathogenic agent into the animal and the occurrence of the first clinical signs of the disease. See www.oie.int/index.php?id=169&L=0&htmfile=glossaire.htm

The virus is more susceptible to the action of alkali than to acid. Strains of ND virus vary in their sensitivity to heat inactivation; the degree of inactivation depends on the initial titre of the virus and the nature of the suspending medium (Biosecurity Australia 2008).

The presence of lipid in the ND virus envelope makes it highly susceptible to disinfectants containing detergents (see Section 4.3.10).

Environment (including windborne spread)

Contaminated water has been suggested as a possible environmental reservoir of virus, a facilitator of interspecies transmission and a means of possible spillover from wild birds to domestic poultry (Snoeck et al 2013, Davis-Fields et al 2014, Dimitrov et al 2016). The virus also survives for long periods in faeces (OIE 2013).

The survival times of various ND virus strains in soil and litter, and on hessian bags and feathers (see below) demonstrate the ability of the virus to withstand adverse environmental conditions and the capacity of these materials to act as vehicles for virus spread (Guan et al 2009). Survival times depend on environmental temperatures and relative humidity. Cold, wet weather can increase virus survival time, whereas hot, dry weather may shorten it (Lancaster & Alexander 1975). Survival of virus in aerosols was improved at a relative humidity of 60–80% (Hugh-Jones et al 1973).

Spread of ND virus by wind during outbreaks in the United Kingdom in the 1960s and early 1970s was reported to be important (Dawson 1973). However, aerosol spread was not considered important in the ND outbreaks in Nigeria (Nwanta et al 2008), the southern and western United States (California) (Utterback & Schwartz 1973, Lancaster & Alexander 1975), or the United Kingdom and Europe in the 1980s and 1990s (Alexander 2000a). More likely explanations for spread of infection in these more recent outbreaks include movement of birds, humans and equipment (Alexander 2000).

However, although relatively little experimental evidence exists for the spread of infection by aerosol, virus has been detected up to 165 m downwind from infected poultry houses (Hugh-Jones et al 1973). Where poultry farms are concentrated in a region and climatic conditions are favourable, it is likely that airborne spread will play a role. In Australia, increased levels of seroprevalence of ND virus were found in areas with the highest density of poultry farms; this could be due to airborne spread or movements between farms (East et al 2006).

Feathers are known to harbour ND virus for long periods (Lee et al 2016). If disinfection on infected premises is inadequate, infection could be spread by feathers blown by wind. Windborne transmission by infected feathers and other debris in litter and faeces during cleanup operations probably played a part in local spread in the Californian outbreaks during the 1970s; for this reason, Dutch authorities in the 1990s imposed bans on the disposal of litter by spreading on fields within 500 m of poultry sheds (Alexander 2001, 2011).

In Australia, windborne spread by contaminated feathers, dander and other debris in litter should be seriously considered as a source of virus.

For comment on the aerosols produced during infection, see 'Live domestic poultry', below.

Live animals

Live domestic poultry

ND virus is present in most tissue secretions and excretions of acutely infected poultry from 24 hours before clinical signs appear, and throughout the clinical disease stage and death. Virus can be recovered from poultry for at least 7 days after infection (Cattoli et al 2011).

Within a flock, the main method of transmission is by inhalation of virus-laden expired air, or ingestion of drinking water or feed contaminated with nasal secretions or faeces containing virus. Coughing is not necessary to produce infective aerosols, which are distributed by normal air turbulence in poultry sheds. Air sampling during outbreaks has shown high levels of virus in hen houses (Hugh-Jones et al 1973, Hietala et al 2005). Vaccination markedly reduced excretion of virulent virus; however, clinically normal vaccinated birds still excreted virus following challenge, providing a source of contamination and spread (Hugh-Jones et al 1973, Parede & Young 1990, Alexander 2000a).

Movement of infected and contaminated live birds is the single most important means of spreading ND. Day-old chickens transported in contaminated carrier boxes caused significant spread of infection in California in 1972 (Utterbuck & Schwartz 1973). The sale of infected birds to farms and dealers from a single hatchery resulted in 254 outbreaks in Italy in 2000 (Capua et al 2002). Trade in backyard and fancier poultry was implicated as a significant source of spread of infection in the European Union from 1991 to 1994, and live poultry markets are known to spread the virus, with healthy-looking birds confirmed to carry virulent ND virus (Samuel et al 2013, Byarugaba et al 2014).

Ducks and geese can be reservoirs of virus. ND outbreaks have occurred where a virulent virus that did not cause clinical signs in infected ducks and geese was transmitted from these species to domestic poultry (Beard & Hanson 1984).

Other birds

Psittacines and other cage birds

Psittacines have been shown to excrete virulent ND virus for up to 1 year and initiated ND panzootics in various parts of the world in the 1970s. A virulent ND virus which entered the USA via illegal importation of psittacine bird was identified as the cause of ND outbreaks in poultry in the early 1970s in southern California (Utterback and Schwartz 1973; Seal et al 1998). In Australia, during the 1970s, AOAV-1 capable of causing severe respiratory disease in young chickens was isolated from a cockatoo illegally imported from Indonesia (Eaves & Grimes 1978). The potential for ND to be spread by wild birds, including psittacine species, to susceptible poultry should be taken into consideration during response to an outbreak in Australia (Erickson et al 1977).

The virulent ND isolates from the outbreaks in cormorants in the USA and Canada in 1990 and 1992 were considered probably related to isolates of psittacine origin (Seal et al 1995; Seal 1996).

Variation pathogenicity and transmissibility of virulent ND viruses isolated from poultry (chicken) versus virulent ND strains isolated from pigeons and cormorants has been demonstrated (Ferreira et al 2019).

Canaries are susceptible to infection with ND virus but not to become carriers (Erickson et al 1977). Virulent NDV has been isolated from faeces of clinically healthy captive Columbiformes (pigeons and doves), Psittaciformes (parrots), phasianiformes (gallinaceus birds) and passeriformes (songbirds) in a zoological park in India (Roy et al 1998). A study testing cage birds in Tehran by RT-PCR identified psittacines and passerines positive for velogenic ND virus without clinical signs, identifying these birds as reservoirs of ND and a source of infection for other birds, including poultry (Madadgar et al 2013). Experimental studies demonstrated pathogenicity of NDV isolated from wild cattle egrets and house sparrows in Egypt in chickens (Elfatah et al 2021).

Captive cage birds have frequently been shown to be infected with AOAV-1, often without clinical signs (Falcon 2004) and outbreaks have established in commercial and backyard poultry from such sources. The source of some of the outbreaks in poultry in the 1970s in the USA were traced to imported cage birds (Walker et al 1973),

ND virus was recovered from more than 25% of imported pet birds during quarantine in the United States and 71% of these were psittacines (Senne et al 1983). Parrots are known to act as reservoirs for virulent ND virus, becoming asymptomatic carriers, (Walker et al 1973, Seal 1996) and Australian psittacine species, if infected, may experience high mortalities and are likely to spread the virus during an outbreak (Bains 1993, Gilchrist 1993, Australian Biosecurity Import Risk Assessment 2020).

Pigeons

After infection with viscerotropic velogenic ND virus (see Section 2.5.1), pigeons excrete virus in the faeces during the acute phase of the disease but not during convalescence. Virus persists for 4 weeks in the trachea and lungs, and up to 5 weeks in the brain.

Pigeons infected with viscerotropic velogenic ND virus excreted virus before the onset of clinical disease. Virus shedding was detected up to 21 days postinoculation in some birds, and infected pigeons were able to transmit the virus to chickens and other pigeons by contact (Erickson et al 1980). More recently, pigeons infected with the ND virus from the 2002 Californian outbreak were positive for virus isolation 2–8 days postinoculation without overt signs of disease (Wakamatsu et al 2006). In another study, pigeons inoculated with an ND virus from an outbreak in Brazil, and all in-contact pigeons, seroconverted and excreted virus for up to 20 days (Carrasco et al 2008).

Pigeons experimentally infected with a lentogenic virus developed mild respiratory signs and conjunctivitis 6 days later, and excreted virus for 3–7 days (Videvogel & Duchatel 1986).

Pigeons can spread ND virus by faecal contamination of poultry feed. Close interactions between feral pigeons and racing pigeons in urban and rural environments favoured the spread of pigeon-strain virulent ND. Cage and aviary birds could become infected by contact with infected pigeons.

Pigeons were responsible for spreading a particular strain of AOAV-1 virus – which had some antigenic differences from classical strains (Alexander 2000a) – across Europe in the 1970s. This appears to be the only panzootic in which pigeons are known to have played a major role in the spread of disease.

Pigeons had close contact with one infected flock in New South Wales but did not develop clinical signs or serological responses to Australian-origin ND viruses.

Waterbirds

Cormorants in Canada and the United States have maintained virulent ND virus infections for many years (Alexander 2000a, Diel et al 2012, Brown & Bevins 2017). The outbreaks cause high mortalities in young birds with few if any signs of disease in adult birds (Cross et al 2013, White et al 2015). In one outbreak in 1992 the ND virus was passed from cormorants to free ranging turkey flocks nearby (Heckert et al 1996).

Avirulent ND virus strains are regularly isolated from apparently healthy wild gulls, waterfowl and shorebirds, with virus shed in faeces (Alexander 2000, Dimitrov et al 2016).

Ducks are reported to be readily infected with ND virus and capable of spreading the virus, however, there are few reports of clinical ND in ducks. A New Zealand study identified AOAV-1 strains in wild duck populations that are very closely related to viruses thought to have mutated to virulence elsewhere (Stanislawek et al 1995). Geese can be infected with ND virus, and the disease is often subclinical making them a risk for spread of the virus, however a number of outbreaks in geese have occurred in China (Wan et al 2004).

In Europe in the 1990's waterfowl migration was considered a possible contributor to the introduction and onward spread of ND virus in 1990s (Alexander 2000, Alexander 1998).

Wild waterfowl can be reservoirs of avirulent Newcastle disease viruses.

Some phylogenetic studies provide evidence for migratory bird movement as a possible mechanism for intercontinental virus spread of AOAV-1 (Liu et al 2020, Hicks et al 2019).

No virulent strains of AOAV-1 have been detected in wild birds in Australia, including samples collected from apparently healthy wild water birds since 2017 as part of the National Avian Influenza Wild Bird (NAIWB) Surveillance Program which is a program run by Wildlife Health Australia (WHA).

Avirulent AOAV-1 viruses have been isolated, or detected in, a wide range of wild aquatic birds, mainly waterfowl, sampled in locations across in Australia (NAIWB Surveillance Program, Alexander et al 1986; Peroulis and O'Riley 2004; Hoque et al 2012). Prevalence of these avirulent strains is reported to vary from 0.04% in non-aquatic birds to 7% in aquatic birds (Peroulis and O'Riley 2004; Hoque et al 2012). Studies have found evidence of exposure to APMV in 10-16% of grey teal (*Anas gracilis*) *sampled* in Victoria (Hore 1973) and in a range of *Charadriiformes*, *Passeriformes* and *Anseriformes* in Western Australia (Alexander et al 1986).

Recent phylogenetic analysis of wild bird and poultry samples collected from 2006 – 2019 indicates that there are 5 main clusters of APMV-1 circulating in Australia. Whilst the poultry viruses form a single cluster, the wild bird viruses form four clusters.

Other Australian studies have failed to find evidence of APMV-1 in wild birds (Garnett & Flanagan 1989; Diallo et al 2006). Other than PPMV-1, APMVs have not been reported to cause disease in wild birds in Australia (Ladds 2009).

Pheasants, partridges and quail

Pheasants, partridges and quail are all susceptible to natural ND virus infection. Although mortalities have been recorded, infection usually produces only mild disease, except in quail, which are very susceptible.

Game birds have all been involved in ND outbreaks, some of which resulted in spread of disease to domestic poultry (Nolen 2002).

Ratites

Ratites are susceptible to infection but are probably fairly resistant to developing clinical signs so may act as a reservoir of infection. In 1993, three outbreaks occurred on ostrich farms in South Africa however, the mortality rate was low with limited spread (Alexander 2000b).

In an outbreak in Israel, 13 of 46 ostriches aged 5–9 months died with typical nervous signs of ND while older, in contact birds did not develop disease. The virulent Israel-67 strain of ND virus was isolated (Samberg et al 1989).

In a study in India, 15.3% of 202 blood samples collected from eight emu farms were positive for AOAV-1 (Shinde et al 2021).

Native Australian birds

Numerous native Australian birds have been shown to be susceptible to ND (Bains 1993, Gilchrist 1993). Monitoring of wild aquatic birds (including ibis and ducks) for ND virus in north Queensland indicated an overall prevalence of 3.5% by PCR (Hoque et al 2012). However, no evidence of ND virus infection was found in native birds sampled during the 1998–2000 outbreaks in New South Wales. Amery-Gale 2018 failed to detect AOAV-1 viruses in a study that screened samples collected from 409 wild and captive birds [299 = wild bird; 110 = captive all from one zoological collection] that presented to the Australian Wildlife Health Centre at Zoos Victoria's Healesville Sanctuary for veterinary care between December 2014 and December 2015.

Inapparent (subclinical) carriers

Virus can remain latent in the trachea and has been recovered by organ culture from the trachea of one bird 120 days after infection (Heuschele & Easterday 1970). Virulent ND virus has been detected in infected vaccinated flocks for more than 4 months (Krauss 1965, Utterbuck & Schwartz 1973). Latent ND virus in vaccinated or nonvaccinated birds may be shed by:

- birds that shed virus spontaneously and intermittently
- birds subjected to stresses, such as transport or intercurrent disease
- carrier birds whose carcasses are fed to other animals in which digestive enzymes release virus from antigen–antibody complexes.

Live wild (including feral) animals

ND virus can be transmitted from endemic foci among wild birds to poultry. Wild birds can also act as mechanical vectors of the virus from an infected poultry premises to other susceptible poultry. Vaccine-derived ND virus was repeatedly isolated from wild birds on four continents between 1997 and 2014.

Carcasses

ND virus remains viable in the carcasses of birds until decomposition is well advanced. It is stable in nonputrefying tissue and organ samples, and faeces, if not exposed to high temperatures, and has been

isolated from bone marrow held for several days at 30 °C (Omojola & Hanson 1986). Most body organs contain virus at some time during infection.

Animal products

ND virus can be transmitted by insufficiently treated poultry meat products, table eggs and egg pulp products (see 'Meat, meat products and casings, including use as animal feed' and 'Eggs and egg products', below). However, the significance of transmission by these routes in outbreaks diminished from the 1960s to the 1990s (Alexander 2000a). The risk of human infection with ND virus from consumption of properly cooked animal products and raw egg products is negligible.

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

Birds slaughtered for meat during an outbreak can be a significant source of virus. Infectious virus has been recovered from meat after 250 days at –14 °C to –20 °C, and from skin and bone marrow after 250 days at –4 °C (Asplin 1949). In overseas outbreaks, frozen meat products have been a significant means of spread, especially when uncooked poultry scraps have been fed to poultry. There is evidence that feeding of uncooked poultry offal and scraps to susceptible birds helped to spread the disease in the Melbourne outbreaks of 1930 and 1932 (Arzey 1989). It is illegal to feed untreated poultry offal and poultry scraps to commercial poultry in Australia.

Poultry meat was incriminated as the major means of introduction and spread of ND virus in the United Kingdom in the 1940s to 1960s. Sixty-six per cent of imported poultry meat was infected, and disease was spread when poultry waste was fed to poultry (Dawson 1973). Better hygienic practices in poultry slaughter establishments have greatly reduced the risk of spread from poultry waste (Alexander 2000a).

The ability of ND virus to maintain infectivity under various heat regimens used in cooking varies considerably between strains. For example, stability at 56 °C varies from 5 to 240 minutes (Arzey 1989).

The generic import risk analysis conducted by the then Biosecurity Australia determined that, to ensure destruction of ND virus, chicken meat needed to be heated to a minimum core temperature of 70 °C for at least 8 minutes and 12 seconds, or for equivalent time and temperature (Biosecurity Australia 2008). Significant tailing-off of virus inactivation at temperatures below 70 °C is often observed, so there is little confidence that cooking processes below 70 °C can be relied upon to inactivate ND virus.

Arzey (1989) reviewed the actual cooking temperatures and times used for cooked and partially cooked poultry meat products (including nuggets, crumbed chicken pieces, schnitzel, loaves, roasted chicken, offal and meatmeal). Industry sources agree that precooked products for the retail market (eg roasted and smoked poultry, poultry rolls) and secondary products (eg poultry stock cubes, soup mixes, canned and dried pet foods) all satisfy the minimum core temperature requirements. For flash-fried products, such as nuggets, the cooking time is so short that the internal temperature is unlikely to be raised sufficiently to kill ND virus. However, further cooking at fast-food outlets is sufficient to kill the virus. The virus may also survive in fully cooked nuggets sourced from supermarkets, as they reach a core temperature of 75 °C for only 1 minute. However, fully cooked nuggets are recooked by the consumer before serving.

Packaging and the drip that develops during storage of poultry meat are important, as both can be contaminated with virus from infected carcases (Lancaster & Alexander 1975). However, infected carcases were not important in the spread of ND in outbreaks overseas in the 1980s and 1990s (Alexander 2000a).

Eggs and egg products

Although severely affected birds cease to lay, eggs laid in the early phase of an outbreak could carry ND

virus internally (via vertical transmission) and on the surface. The virus can penetrate cracked or intact shells or, more significantly, contaminate egg fillers. Isolation of lentogenic viruses from eggs has been reported more often than isolation of virulent viruses from eggs.

The survival time on eggs and fillers is sufficient to allow wide dissemination of virus. Thus, trace-back should be undertaken to any farms that may have had contact with infected eggs, packaging material, vehicles and personnel (through common sources such as packing floors and distributors) in the 21 days before the first signs of disease. Sanitising the eggs, and using new fillers or treating fillers with a sanitiser containing 50–200 ppm of available chlorine or other registered sanitisers will eliminate the virus from clean surfaces. Cardboard fillers should not be reused under any circumstances.

Recovery of ND virus from eggs of birds vaccinated 35 days previously has been reported (Tanwane 1971).

Egg pulp products are another source of ND virus. Pasteurisation and cooking procedures for egg products (FSANZ 2009) are not sufficient to inactivate most ND virus strains, some of which require up to 5 minutes at 67 °C, up to 30 minutes at 58–64 °C, and considerably longer times at 55 °C (Arzey 1989, Biosecurity Australia 2008). The OIE *Terrestrial animal health code* lists the times and temperatures in Table 2.1 as suitable for inactivation of ND virus in eggs and egg products.

Table 2.1 Industry standard times and temperatures suitable for the inactivation of ND virus present in eggs and egg products

Name	Core temperature (°C)	Time
Whole egg	55	2521 seconds (42 minutes)
Whole egg	57	1596 seconds (27 minutes)
Whole egg	59	674 seconds (11 minutes)
Liquid egg white	55	2278 seconds (38 minutes)
Liquid egg white	57	986 seconds (16 minutes)
Liquid egg white	59	301 seconds (5 minutes)
10% salted yolk	55	176 seconds (3 minutes)
Dried egg white	57	50.4 hours

The listed temperatures achieve a 7-log kill. Where scientifically documented, variances from these times and temperatures may also be suitable when they achieve inactivation of the virus.

Fertile eggs (vertical transmission)

Because ND virus is shed in large amounts in the faeces of infected hens, infected and contaminated eggs can be expected to be laid (Beard & Hanson 1984, Alexander 1997). Vertical transmission through eggs has been demonstrated, and ND virus has been isolated from eggs laid by infected breeding hens (Williams & Dillard 1968). Capua et al (1993) isolated virulent ND virus from fertile eggs, embryonated eggs and live progeny of vaccinated breeders. Transmission by this route remains controversial, and its significance for spread of infection in outbreaks is unclear (Alexander 1997). However, some studies have demonstrated the occurrence of vertical transmission to eggs and chicks, which may then present a risk for further spread (Capua et al 1993, Chen & Wang 2002).

Although it is considered unlikely that a live chicken would hatch from an egg internally infected with virulent virus, this has been reported; it may depend on the strain of virus and vaccination of the parent flock (Capua et al 1993).

Fumigation of eggs and strict hatchery hygiene can salvage genetic stock from eggs in an infected flock. As well as strict protocols for these procedures, quarantine, and intensive monitoring and testing of flocks hatched from eggs in an infected flock will be needed.

Animal byproducts

Rendered meals produced from frames (boned-out skeletons), viscera, blood, feathers, feet, heads, necks, offcuts, birds dead in trucks and discarded live birds are usually cooked at above 100 °C during processing, for several minutes to more than 1 hour, which is sufficient to kill ND virus. However, if the procedure is not carried out properly or cooked product is subsequently contaminated by unprocessed product, ND virus could persist for several weeks. As a precaution, rendered poultry meals from infected birds should not be included in poultry feeds.

Semen and embryos from live susceptible animals

ND virus can be transmitted via semen. Turkey semen from viraemic birds is likely to be contaminated with virus, and this poses a risk when the semen is used for artificial insemination.

Waste products and effluent

Waste includes any of the waste streams or byproducts of farming (eg dead birds, chicken manure, litter), egg production and marketing (eg unsaleable eggs, egg shells after pulping, soiled egg fillers), processing, hatching or laboratories (eg autoclaved cultures and specimens, dead birds). It includes any products that will not be harvested for human consumption.

Most of the waste from egg farms is collected by industrial waste companies, or burned, buried or composted on-site. ND virus has the potential to persist in waste products and could be disseminated by vehicles that transport them unless surface disinfection is carried out.

ND virus can remain viable in poultry faeces, which will readily contaminate people and fomites. Spread of the disease has been associated with the use of chicken manure as fertiliser (Kelly 1973). Several studies on the survival of ND virus in faecal material after the removal of infected birds showed that ND virus can still be isolated at day 16 and suggested that midwinter lower temperatures, higher humidity and moisture, and the presence of organic material to protect the virus favour a longer ND virus survival time (Kinde et al 2004).

In other countries, the route of transmission of PPMV-1 from pigeons to commercial poultry has most often been through feed contamination by faeces or carcasses. Bird-proofing of mills and feed stores is therefore important.

People

During ND outbreaks in the United States in the 1970s, movements of labour crews, feed company deliverers, equipment servicers and farm managers were identified as playing a role in the spread of the disease (Utterback & Schwartz 1973, Walker et al 1973). This could potentially occur via fomites as well as via people infected with the virus.

The role of nonsusceptible animals in the dissemination of ND virus is confined to mechanical transmission.

Crops, grains, hay, silage and mixed feeds

Pelleting of feed at 80–90 °C for 30 seconds is not expected to completely inactivate ND virus (Wooley et al 1981). However, pelleted feed has not been implicated in outbreaks unless contaminated after treatment, such as with infected faeces from pigeons – this occurred in the European ND outbreaks in the 1970s and 1980s.

Vehicles, including empty livestock transport vehicles

Rapid transport methods employed in modern industry are capable of moving contaminated materials over long distances, including interstate, in a few hours. Vehicles must be thoroughly disinfected to prevent spread by fomites.

Equipment, including personal items

Spread of ND virus on fomites during movements by humans is the second most important means of virus spread (after movement of infected birds) during outbreaks. This can occur through movement of personnel and equipment, with transfer of infected faeces on hair, clothing, footwear, crates, feed sacks, egg trays, vehicles or other equipment (Alexander 2000b).

Other relevant considerations

Any animals, including flying insects, that travel between infected and susceptible birds can spread ND virus by mechanical means, although this is uncommon. Rodents harboured ND virus in a 1974 outbreak in California (Johnson 1974) and would need to be controlled during an outbreak response. In the United States, flies have been reported as being able to spread ND virus for up to 10 days and a distance of kilometres. Darkling beetles have also been implicated (De Las Casas et al 1976).

2.4.3 Factors influencing transmission

Some strains of ND virus spread more readily than others. For example, some Australian lentogenic strains have been shown to spread readily in Australia, especially in production systems on litter. Within vaccinated populations, the true transmissibility of a particular strain may not be apparent.

The viability of ND virus in the environment is increased by low temperatures, high humidity and short day length. However, lentogenic strains previously occurred widely in meat chicken flocks in southeast Queensland, an area that rarely has this type of weather. The virus may not survive well in the hot and dry climate of the southern parts of Australia in summer. However, it spread very efficiently under these conditions in southern California in 1972. Spread in California in 1972 was largely through the movement of infected birds, and the movement of people with contaminated clothing and equipment.

Some of the major poultry farming areas in Australia are closely settled and contain large numbers of birds (3 million on one site near Sydney). Areas of high population density will make possible the rapid transmission of the virus to large numbers of other birds. To overcome this danger, some important breeding flocks have been duplicated and moved to locations remote from other flocks.

2.5 Diagnostic criteria

For terms not defined in the text, see the *Glossary*.

2.5.1 Clinical signs

The clinical signs of ND virus infection are very variable. They depend on the virulence and tissue tropism of the virus strain; the species, age, immune status and condition of the infected bird; the route of exposure; the magnitude of the infecting dose; and external factors, such as type of housing, and environmental and social stress.

Animals

Clinical ND has been broadly classified into four syndromes, based on the disease in domestic chickens:

- velogenic
- viscerotropic velogenic – high mortality; haemorrhagic enteritis is the predominant lesion
- neurotropic velogenic – high mortality; respiratory and nervous signs predominate
- mesogenic – low mortality; respiratory signs usually predominate
- lentogenic – mild; respiratory disease or subclinical infection predominates
- asymptomatic – no noticeable clinical signs of infection.

Infections caused by velogenic viruses (virulent ND viruses) fulfil the OIE criteria for listing (see Section 2.1).

An outbreak of ND in chickens may be so severe that almost all birds of an affected flock die within 72 hours without noticeable signs, often leading to a suspicion of poisoning. In adult layers, a marked drop in production may be the first sign, followed in 24–48 hours by mortality, which can reach 100%. Clinical signs noted may be:

- a sudden drop in egg production, often accompanied by production of abnormal eggs (misshapen, soft or missing shells with loss of normal pigment)
- loss of appetite, fever and weakness
- swelling and cyanosis of the comb and wattles
- watery, bile-stained, distinctive bright green or bloody diarrhoea
- respiratory signs, which may include increased respiratory rate, respiratory distress, coughing and a high-pitched sneeze ('snick')
- nervous signs, which can include loss of balance, circling, backward progression and convulsive somersaulting, rhythmic spasms, stiff and wry neck, head tremors, and wing and leg paralysis (for further details, see Geering et al 1995).

The high rates of morbidity and mortality, and distinctive clinical signs usually seen with exotic ND outbreaks were not often seen in the Australian-origin outbreaks from 1998 to 2002. The most frequently seen clinical signs (singly or in combination) were depression; nervous signs such as ataxia, paralysis, abnormal posture (opisthotonus) and head nodding; increased mortality; and changes in egg shell colour.

Laboratory studies comparing exotic and Australian-origin ND viruses have shown that the Australian viruses have comparable lethality to exotic ND viruses (Herts 33 and Texas GB) by parenteral inoculation (intracerebral and intravenous), but not all Australian-origin viruses are as lethal or as

transmissible following ocular, oral and nasal inoculation. Following infection and transmission by the natural route of direct contact with other birds, all birds infected with the exotic ND groups were dead by 11 days, whereas most birds infected with Australian-origin viruses were alive at 10–15 days (P Selleck, CSIRO-AAHL, pers comm, 2003).

2.5.2 Pathology

Gross lesions

Young chickens, or those dying from the peracute form of the disease (causing very rapid death), may not have any gross lesions.

In the viscerotropic form, oedema of the interstitial tissues of the neck, especially near the thorax, may be marked. Haemorrhages occur in the trachea, corresponding to the rings of the cartilages, and in the proventriculus, gizzard, Peyer's patches, caecal tonsils and other aggregations of lymphoid tissue in the intestinal wall. Diphtheritic membranes may be present in the oropharynx, trachea and oesophagus. Lesions in the gastrointestinal tract progressively become oedematous, haemorrhagic, necrotic and finally ulcerative. Small, flat, red or purple (petechial) haemorrhages may be seen on the breast muscle, heart muscle and peritoneal adipose tissue, and on serosal surfaces.

In the neurotropic form, there is usually a severe haemorrhagic inflammation of the trachea, although it is rare to see free blood in the lumen. Such lesions were not seen in the Australian-origin outbreaks from 1998 to 2002. Haemorrhagic lesions sometimes occur in the proventriculus, but rarely in the rest of the alimentary tract. Gross lesions may not be present in birds that show only nervous signs.

Birds that are partially immune to ND will have gross lesions that are less severe; the severity of lesions decreases with increases in the birds' degree of immunity.

Pathological changes were absent or subtle in many chickens during the 1998–2002 Australian-origin ND outbreaks.

Microscopic lesions

Histologically, brain lesions are of value in diagnosis. There is neuronal degeneration, gliosis, perivascular lymphocytic infiltration and, very characteristically, hyperplasia of vascular endothelium. Necrosis of the endothelial lining of blood vessels, thrombosis, oedema and haemorrhages may be seen in all organs. There may also be pronounced oedema and cellular infiltration of the submucosa of the nasal tract and trachea, and of the lungs and air sacs (Geering et al 1995).

In the 1998–2002 Australian-origin ND outbreaks, there was multifocal perivascular lymphocyte cuffing, particularly in the brain stem, and sometimes multifocal gliosis and areas of neuronal necrosis.

2.5.3 Differential diagnosis

Terregino & Capua (2009) provided detailed descriptions of the clinical signs and pathology of ND in many susceptible species. However, none of the clinical signs or lesions described are specific for ND, which makes laboratory confirmation of a field diagnosis mandatory.

The clinical signs and course of virulent ND may closely resemble those of a number of other avian diseases and conditions:

- highly pathogenic avian influenza
- fowl cholera
- laryngotracheitis (acute form)

- fowl pox (diphtheritic form)
- psittacosis in psittacine birds and pigeons
- infectious bronchitis
- Pacheco's parrot disease (in psittacine birds)
- infection with avian paramyxovirus types 3 and 5 in some psittacine species
- infectious bursal disease (Gumboro disease) (very virulent strains)
- salmonellosis (in pigeons)
- other septicaemic infection (eg *Escherichia coli*, *Erysipelothrix rhusiopathiae*)
- acute poisoning
- management errors (eg deprivation of water, air, feed).

2.5.4 Laboratory tests

Samples required

Samples should be taken both from live, clinically affected birds and from recently dead birds. Serum, cloacal and tracheal swabs (in virus transport medium or phosphate-buffered glycerol saline), and/or fresh faeces should be taken from live birds. From dead birds, cloacal/tracheal swabs, alimentary tract tissues (proventriculus, intestine, caecal tonsil), respiratory tissues (trachea, lung) and neurological tissues (brain), as well as heart and kidney, should be collected.

Transport of specimens

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

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

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

Packing specimens for transport

Unpreserved tissue and blood specimens should be forwarded with water ice or frozen gel packs (dry ice or liquid nitrogen if a delay of more than 48 hours is expected) in an International Air Transport Association–approved specimen transport container. For further information, see the **AUSVETPLAN management manual *Laboratory preparedness***.

2.5.5 Laboratory diagnosis

Although a wide variety of serological tests for ND virus are available, including enzyme-linked immunosorbent assay (ELISA) and haemagglutination inhibition (HI) tests, the performance of these assays varies, and not all are suited to routine diagnostic use. The HI test is currently the most widely used serological test worldwide and produces very few false positive reactions with fowl serum that has not been exposed to ND virus.

The value of serology in diagnosis depends on the expected immune status of the flock, and serological titres need to be interpreted cautiously. Although positive serology indicates that a response to ND virus antigen has occurred, it does not provide a reliable guide to the pathotype of any infecting virus(es). Many poultry flocks in Australia seroconvert as a result of vaccination, or infection with low-pathogenicity or avirulent ND viruses.

Therefore the usual approach to ND diagnosis in Australia is screening by RT-PCR. Any positives are further characterised by culture in eggs and further molecular (genetic) analysis. Analysis of viral genetic sequence data allows assessment of pathogenicity (see below) and more detailed phylogenetic analysis. Isolates obtained from egg culture are identified antigenically by HI and molecular tools.

CSIRO-ACDP tests

The testing method used by CSIRO-ACDP is shown in Figure 2.1.

Further details of tests currently available at CSIRO-ACDP are shown in Table 2.2.

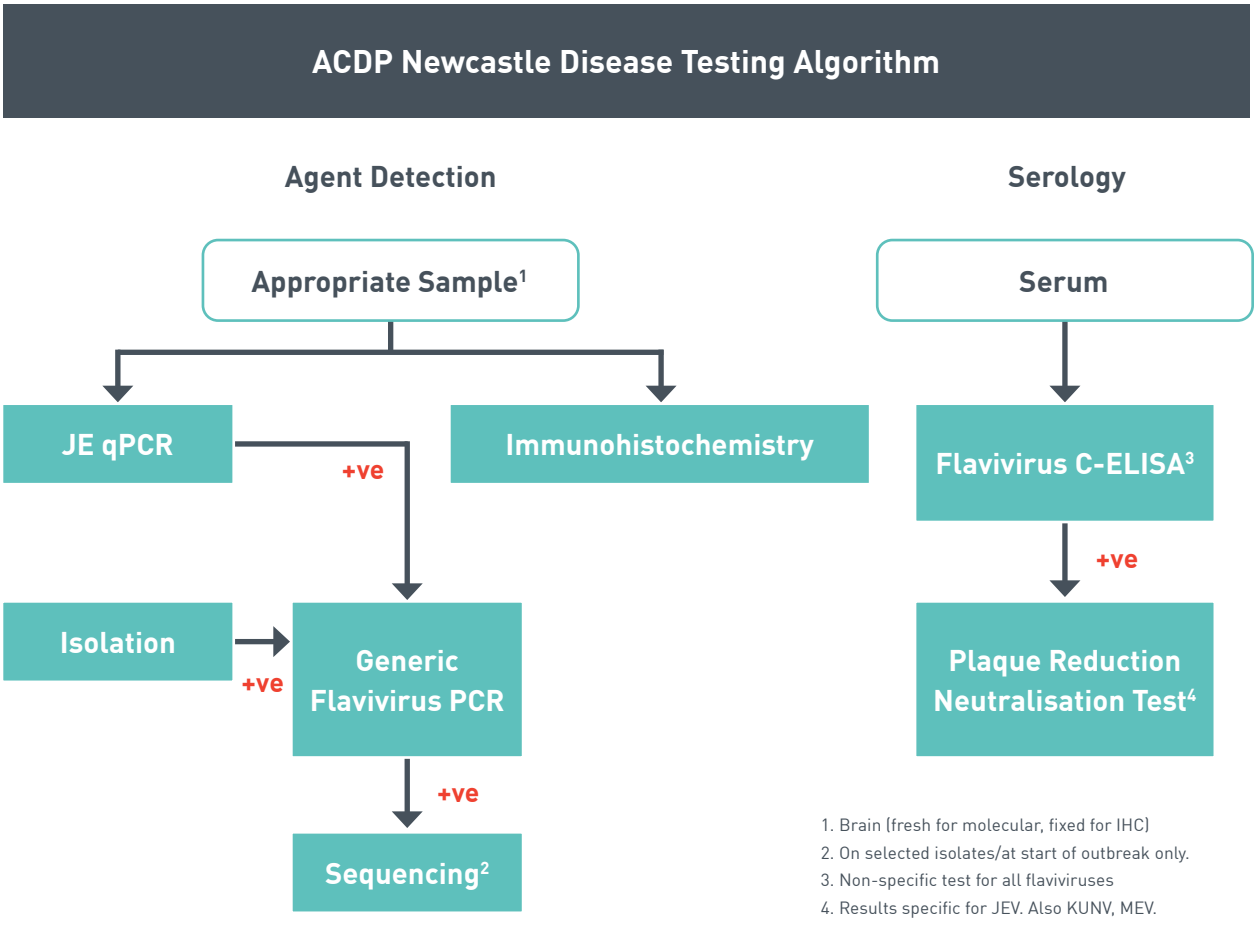

Figure 2.1 The current approach to diagnostic testing at CSIRO-ACDP

Table 2.2 Laboratory tests currently available at CSIRO-ACDP for the diagnosis of Newcastle disease

Test	Specimen required	Test detects	Time taken to obtain result
Agent detection			
qRT-PCR	Swabs, tissues or cultured virus	Viral RNA	4 hours
Immunohistochemistry for antigen detection	Fresh and formalin-fixed tissues	Viral antigen	2–3 days
	Paraffin tissues	Viral antigen	1 day
EM and immuno-EM	Tissues, culture material	Virus	1 day
Agent characterisation			
Virus isolation and identification	Tissues	Virus	2–4 days
RT-PCR and sequencing	Swabs, tissues or cultured virus	Viral RNA	2–3 days
PCR pathotyping	Swabs, tissues or cultured virus	Virulence	1 day
Intracerebral pathogenicity index	Virus isolated in eggs	Virulence	5 days
Serology			
Haemagglutination inhibition	Serum	Antibody	6 hours
ELISA	Serum	Antibody	8 hours

ELISA = enzyme-linked immunosorbent assay; EM = electron microscopy; PCR = polymerase chain reaction; qRT-PCR = quantitative real-time polymerase chain reaction; RT-PCR = reverse transcription polymerase chain reaction

Source: Information provided by the then CSIRO-AAHL, 2010 (refer to CSIRO-ACDP for most up-to-date information)

Other tests

Tests for pathogenicity

The extreme variation in virulence between strains of ND virus, the widespread (but variable) occurrence of low-pathogenicity strains in Australia and the use of live virus vaccines mean that the isolation of ND virus from a bird showing clinical signs of ND does not confirm a diagnosis of ND. An estimate of the virulence of the isolate is therefore required to differentiate between vaccine, endemic avirulent, Australian-origin virulent and exotic virulent strains. This is usually based on one or more pathogenicity tests. The OIE *Manual of diagnostic tests and vaccines for terrestrial animals* recommends two tests:

- PCR pathotyping test
- intracerebral pathogenicity index (ICPI) in day-old chicks.

In Australia, the main test used is the PCR test. The ICPI is very rarely used. PCR pathotyping is based on analysis of the derived amino acid sequence of the cleavage site of the viral F0 glycoprotein.

2.6 Resistance and immunity

Innate immunity

Different strains of chickens vary in their response to ND virus infection. Younger birds develop clinical signs more quickly and are more severely affected, although chicks from immune hens may be protected by antibody derived from the yolk.

Acquired immunity

It is likely that the bird's full range of immune mechanisms is involved in the immune response.

Cell-mediated immunity can be demonstrated 2 days after infection. All ND virus strains cause an antibody response in chickens and other avian species. However, titres in cage and aviary birds following natural infection with lentogenic strains are not known. Serum antibody can be detected in chickens 6–10 days after infection. Titres peak after 3–4 weeks and decline to undetectable levels in 8–12 months.

Neutralising antibody protects chickens, chicken embryos and cell cultures from infection. Birds that are resistant to infection have high levels of circulating antibody. Low levels of antibody may not prevent infection but can protect chickens from severe disease and mortality. It has been demonstrated that vaccinated birds without detectable antibody may survive challenge with virulent virus. This may be due to low levels of humoral antibody, interference between vaccine and challenge virus (which compete for cell attachment sites), cell-mediated immunity, and/or local immunity.

Resistance to ND virus infection may be evoked by previous inapparent infection with an avirulent virus, such as the V4 strain. Before the current vaccination regime, some Australian flocks were reported to be partially immune after natural exposure to lentogenic and asymptomatic field strains of ND virus (Spradbrow et al 1980). In immune and partially immune flocks, exotic ND – or a virulent virus arising by mutation from a precursor strain such as Peats Ridge – could remain undetected while the virus is being excreted by symptomless infected birds and few deaths are occurring. This raises the possibility of exotic ND virus spreading undetected in Australia for a period before causing a sudden, explosive and widespread epidemic in unprotected flocks. However, this situation of widespread infection did not arise in 1999–2000 in Australia, as evidenced by the national survey of ND viruses in the second half of 2000 (National Newcastle Disease Virus Survey 2000, unpublished),[7] which demonstrated only the isolation of V4-like viruses and no pathogenic ND viruses. Peats Ridge or other precursor viruses were not isolated on any vaccinated properties, although Peats Ridge virus was isolated on four properties where vaccination had not been used.

2.7 Vaccination

Under the National Newcastle Disease Management Plan (NDMP),[8] industry has conducted compulsory vaccination of long-lived birds since 2002–03. Thus, vaccines for ND are already available and being used in Australia.

7 Reported in Rural Industries Research and Development Corporation, Annual report 2000–01, Sections 3.1 (Chicken meat) and 3.2 (Eggs)

8 www.animalhealthaustralia.com.au/newcastle-disease-management

Newcastle disease vaccines are available and being used in Australia.

Short-lived birds (broilers) were included in the vaccination regime for previous iterations of the NDMP. Vaccination of these birds is now based on the risk status of the jurisdiction and protocols outlined in the NDMP to be followed for different risk statuses. Victoria and New South Wales require broiler vaccination; Queensland and South Australia allow opt-out vaccination for broilers if a surveillance protocol is implemented; and Western Australia and Tasmania do not require vaccination of broilers.

Both naturally occurring ('live') and inactivated ('killed') vaccines have been developed overseas. Live vaccines based on lentogenic strains of virus, such as B1, La Sota, F and V4, which have proven efficacy against ND, have been successful in controlling ND outbreaks in many parts of the world. Nonpathogenic and lentogenic virus vaccines are generally administered by eye drop, in drinking water, or by coarse spray intranasally.

Mesogenic strains are not considered for use in Australia because the vaccine virus is capable of causing significant disease in fully susceptible poultry.

Parental immunity interferes with vaccine effectiveness. Vaccination programs are therefore often delayed until chicks are 1–2 weeks old. Meat chickens are vaccinated at 1 day old in the hatchery.

Live vaccines have the advantages of relatively low cost, stimulation of local immunity, ease of application through mass application, and ability to protect soon after vaccination. The efficacy of lentogenic virus vaccines depends on the ability of the vaccine virus to multiply in chickens and stimulate immunity, particularly in the face of maternal immunity. Their ability to spread from bird to bird is also important in exposing all birds to infection.

The disadvantages of live lentogenic virus vaccines include short-lived immunity. Immunity is currently considered to last 10–12 weeks. To maintain adequate protection, repeated vaccinations are needed (every 6–8 weeks). Live vaccines can also produce disease in the presence of complicating infections such as infectious bronchitis, mycoplasma and other respiratory infections. For this reason, viruses of very low pathogenicity are used for initial vaccination, and multiple vaccinations are required.

Oil-based, inactivated vaccines are widely used and are usually injected intramuscularly. These vaccines have been used where ND is endemic, to revaccinate laying and breeding birds previously vaccinated with a live lentogenic vaccine. The double vaccination is claimed to produce a stronger and more durable immune response. Revaccination close to the point of lay using an oil-based, inactivated vaccine protects the bird for the whole of the laying period. Simultaneous use of live B1 oral spray and subcutaneous oil-based inactivated vaccine has protected chickens vaccinated as day-old chicks for 12 weeks. Similarly, Arzey & Pearce (2001) demonstrated that simultaneous use of V4 and inactivated La Sota vaccine produced mean HI titres of 2^7 (range 2^5–2^{11}) for up to 3 months.

Field vaccination trials have shown that V4 strain vaccine may be effectively administered en masse to Australian chickens housed under commercial conditions on litter (Bell et al 1991). Layers in cages can be vaccinated with a combination of live V4 by water vaccination and live V4 intramuscularly (Arzey & Arzey 1999), or live V4 by water vaccination and inactivated vaccine (Arzey & Pearce 2001).

Westbury et al (1984) demonstrated that virulent ND virus used as challenge was excreted for a shorter period and at reduced frequency following vaccination with inactivated V4 vaccine. A similar study confirmed reduction in shedding of challenge virus following vaccination with live V4 vaccine strains (Selleck et al 2004). It is known that birds vaccinated with other vaccines can excrete virulent virus after challenge. Infection in such birds is likely to significantly boost antibody titres.

Vaccination with V4 strain virus was used in 1999 in Australia when the Peats Ridge precursor virus was detected in the Mangrove Mountain area of New South Wales in chicken flocks 2–3 months after restocking of depopulated and disinfected properties. Vaccine was used to suppress the spread of Peats Ridge virus in the hope that infection with this strain and Somersby variant viruses would ultimately be eradicated in the Mangrove Mountain area. Layer poultry farms infected with endemic virulent ND viruses outside the Mangrove Mountain area were also vaccinated with V4 virus to suppress and eradicate Australian-origin virulent ND and precursor viruses before the slaughter-out of these flocks in 2001.

The national survey for ND viruses in 2000 did not detect Peats Ridge virus, other precursor viruses or virulent viruses in New South Wales or the rest of Australia. Further surveillance in 2001 has found precursor viruses of the Peats Ridge type on a small number of properties that were not vaccinated, in areas where virulent ND virus had been detected.

It is not known whether compulsory vaccination with V4 strain in an area will eliminate infection with other, exotic ND strains. Blanket vaccination with La Sota and other vaccines has eliminated infection in some countries with exotic ND viruses. However, exotic ND viruses circulate widely in Asia and are evolving. Some recent strains have resisted immunity generated by existing vaccines and would require new vaccines that may not be available for import from countries with an equivalent disease status to Australia (Wang et al 2015). The NDMP requires effective vaccination, protection against reintroduction of virulent ND infection, and tight biosecurity on individual farms.

2.8 Treatment of infected animals

Treatment of birds with ND is ineffective and is not recommended.

3 Implications for Australia

3.1 Potential pathways of introduction

- Avirulent strains of Newcastle disease (ND) are endemic in Australia.
- The most probable pathway of entry into Australia of virulent exotic ND virus is smuggling of birds, particularly pigeons and parrots (which have the potential to be nonclinical carriers).
- Another route of entry is for the disease to spread from Indonesia to Papua New Guinea and then to Australia. This is regarded as unlikely, given the controlled movement of people and birds in the Torres Strait quarantine zone, and the distance from commercial poultry centres.
- A third potential route is via migratory wild birds, although this has not occurred despite three major epizootics during the past 35 years (1948–83).

3.2 Social, economic and environmental effects

In 2019–20, the gross value of production of the Australian egg industry (farmgate equivalent) was approximately $828.2 million (Australian Eggs 2019), and that of the chicken meat industry $2.78 billion (AgriFutures Australia 2020).

In an outbreak of ND, the main losses will be due to bird mortalities, which can be high, and decreased egg and meat production on infected premises. The policy of stamping out (see Section 4.3) and the time out of production will lead to further loss of income for an extended period. Disruption to the flow of product and decreased production may cause job losses on farms, and in service and associated industries, depending on the time it takes to bring the outbreak under control. Even a small outbreak will result in dislocation in the industry and its normal marketing patterns. An uncontrolled outbreak will markedly increase production costs through the impact of the disease and the need for ongoing control measures.

Other enterprises, such as supply of rendered product to pet food manufacturers, pet shops and exotic bird traders, will also be affected by the control measures adopted.

3.3 Critical factors for an Australian response

- ND virus causes a wide range of clinical conditions in domestic poultry, cage and aviary birds, and wild birds.
- Many of the clinical syndromes of ND mimic those seen in other conditions, including avian influenza.
- ND virus is stable under a wide range of environmental conditions.
- ND virus can spread very easily from flock to flock directly by movement of infected birds, by windborne spread, by faecal contamination of personnel and equipment moving between properties.
- ND virus is infective for almost all avian species, both domestic and wild.

4 Policy and rationale

4.1 Introduction

Newcastle disease (ND) is a World Organisation for Animal Health (OIE)–listed disease that has the potential for rapid spread and is important in the export, import and domestic trade of poultry, other birds and their products. An uncontrolled outbreak of virulent ND has the potential to cause severe production losses, with consequent disruptions and financial losses for the poultry and related industries.

4.1.1 Summary of policy

The policy is to eradicate virulent ND in the shortest possible time, using the most appropriate strategy, while limiting economic impact on the industry. This will be achieved using a combination of strategies, including:

- stamping out, which involves quarantine and destruction of all birds on infected premises (IPs); vaccination before destruction to minimise virus shedding may also be used
- sanitary disposal of destroyed birds and contaminated avian products, to remove sources of further infection
- quarantine and movement controls on birds, avian products and other things in declared areas to prevent spread of infection
- compulsory vaccination of all captive susceptible avian species in declared areas (including those not adequately covered by previous vaccinations)
- widespread voluntary vaccination of other large avian populations in undeclared areas in the vicinity
- decontamination of facilities, products and other things to eliminate the virus on IPs and prevent its spread
- tracing and surveillance to determine the source and extent of infection, and establish proof of freedom from the disease
- zoning to define infected and disease-free areas
- public and industry awareness campaigns to facilitate cooperation from the community and enhance on-farm biosecurity.

4.1.2 Case definition

For the purpose of this manual, a case of ND is defined as laboratory-confirmed infection with virulent ND virus (defined by the cleavage site) in a susceptible animal with or without clinical signs.

Notes:

- Positive serology in the absence of detection of ND virus, with no clinical or epidemiological evidence supporting infection, does not constitute a definition of a case.
- If pigeon paramyxovirus type 1 (PPMV-1) is laboratory confirmed in a pigeon population, an emergency response will not be required. However, laboratory confirmation of PPMV-1 in any other poultry population will require an emergency response because of the ability of the virus to become virulent ND virus through passage.
- AUSVETPLAN case definitions guide when a response to an emergency animal disease (EAD) incident should be undertaken. AUSVETPLAN case definitions do not determine when international reporting of an EAD incident is required.
- At the time of an outbreak, revised or subsequent case definitions may be developed with the agreement of the Consultative Committee on Emergency Animal Diseases (CCEAD).

4.1.3 Cost-sharing arrangement

In Australia, ND is included as a Category 3 emergency animal disease in the Government and Livestock Industry Cost Sharing Deed in Respect of Emergency Animal Disease Responses (EAD Response Agreement – EADRA).[9] When cost sharing of the eligible response costs of an incident is agreed, Category 3 diseases are those for which costs will be shared 50% by government and 50% by industry.

4.1.4 Criteria for proof of freedom

The OIE *Terrestrial animal health code* states that, if ND appears in a free country where a stamping-out eradication policy is practised, with or without vaccination against ND, a period of at least 3 months must elapse after the occurrence of the last case before the country can be declared free again, provided that adequate surveillance has been carried out during that 3-month period. If stamping out is not carried out (with or without vaccination), ND freedom status can be attained 3 years after the last case.

In Australia, vaccination is likely to be an adjunct to the stamping-out policy, and used in association with other control measures.

See Section 7.2 for further details on proof of freedom.

4.1.5 Governance

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

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

4.2 Public health implications

ND has no public health implications for people who are not occupationally exposed. During an outbreak of ND, those who are occupationally exposed should wear personal protective equipment to reduce the risk of transmission.

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

4.3 Control and eradication policy

The objective is to eradicate the disease and to establish Australia's ND-free status in the shortest possible time. This will be achieved by a stamping-out and disinfection policy; imposition of strict quarantine and movement controls, and vaccination to reduce the spread of the disease; detailed and targeted surveillance and monitoring programs to determine the presence and distribution of the disease; disposal of infected animals, and contaminated products and things; and intensive decontamination. Controls over the movement of poultry, fomites and humans in the outbreak area are the key factors in controlling and limiting the spread of ND.

An augmented vaccination program will be a key element in containing the disease or slowing its spread, enabling the salvage of valuable genetic stock, and suppressing shedding of ND virus.

Where an outbreak is detected in an area that routinely vaccinates, the vaccination status of all chickens in the restricted area (RA) and control area (CA) must be assessed. Appropriate action must then be taken to ensure that all flocks are protected according to standards agreed by the CCEAD.

Regular liaison and communication with the poultry industry and government will be essential in making decisions about eradicating ND.

4.3.1 Epidemiological assessment

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

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

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

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

The outcomes of the epidemiological assessment will also be used initially to determine the feasibility of eradication versus long-term control and to guide the selection of other appropriate response measures (including the application of movement controls) and assess the progress of disease control measures.

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

4.3.2 Quarantine and movement controls

See Section 5 for details on declared premises and areas, and recommended quarantine and movement controls.

Quarantine

Quarantine will be immediately imposed on all premises and areas on which infection is either known or suspected.

Premises will be declared (see Section 5). An RA and CA will be declared around the IP (see Section 5).

Movement controls

Movement controls are best implemented through the declaration of declared areas and linking permitted movements to each area. As a general principle, the aim of movement controls is to reduce the spread of disease by preventing the movement of infected animals, infected animal products and infected vectors (where relevant for the disease), and by allowing movements that pose a minimal risk.

Section 6.4 provides details on movement controls for live animals, reproductive material (semen and in vivo–derived embryos), animal products and byproducts, waste products and effluent, and other items that might be contaminated.

4.3.3 Tracing and surveillance

Tracing

Trace-back and trace-forward will commence immediately on suspicion of ND, to establish the extent of the RA and CA. Tracing will cover birds, products, feed, litter, waste, equipment and people. Trace-back will determine movements onto IPs and their origin up to 21 days before the time that mortality and morbidity were first observed on the premises, consistent with the OIE incubation period. Tracing will locate additional IPs, and identify dangerous contact premises (DCPs) and suspect premises (SPs). The original source of introduction of the virus should be traced, as it could remain a threat.

Surveillance

Active surveillance should be initiated as soon as ND is confirmed. In the initial stages, samples should be taken of all poultry and other bird species that die in the RA, and they should be checked for ND lesions; specimens should be submitted to approved laboratories for virus detection (see Section 7.1).

Surveillance also needs to be carried out on all poultry flocks (whether vaccinated or not) in the RA and CA. Field surveillance should seek to detect changes in flock health. Examinations need to be at least twice weekly by:

- producers carrying out their own surveillance, and reporting by telephone
- local control centre officers carrying out regular telephone surveillance of independent premises.

All reports of a decline in health status and/or production should be investigated further. Recommended surveillance procedures are described in Section 7.1.

Although surveillance will begin immediately on and around the IP or infected flock, it will have to be extended very quickly to all other sites where there has been movement of contaminated birds, products and materials from the IP (see Section 7). Information obtained from active surveillance will help to decide the extent of the RA and CA, and identify DCPs and SPs.

Further surveillance of wild birds (beyond sampling of dead birds) to determine their potential involvement in the dissemination of the disease may be necessary (see the **AUSVETPLAN operational manual *Wild animal response strategy***).

4.3.4 Zoning and compartmentalisation for international trade

Where it is not possible to establish and maintain disease freedom for the entire country, establishing and maintaining disease-free subpopulations, through zoning and/or compartmentalisation,[10] may be considered.

In the case of a limited disease outbreak, a containment zone[11] may be established around the areas where the outbreak is occurring, with the purpose of maintaining the disease-free status of the rest of the country outside the containment zone.

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

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

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

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

The OIE guidelines for zoning and compartmentalisation are in Chapters 4.4 and 10.9 of the OIE *Terrestrial animal health code*.

4.3.5 Vaccination

Vaccination, with or without slaughter of birds, is a key component of any eradication strategy. Effective vaccination programs (in which more than 85% of the resident susceptible population is sufficiently immunised), together with other biosecurity measures, across an area where ND viruses have become endemic have led to the eradication of virulent ND viruses in other countries. Because of the range of epidemiological considerations that might apply in an outbreak scenario, decisions on vaccine use will need to be based on the circumstances prevailing at the time.

Vaccination can be applied in such a way that birds become almost refractory to infection with virulent

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

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

ND viruses, although the level of immunity reached with any single dose of ND vaccine during an outbreak will vary greatly, depending on the vaccine used and the host species. Most commercial vaccines have been designed to control clinical signs; however, they do not prevent viral replication and shedding, and are not suitable for eradication on their own. A bird is immune to infection if its antibody titre is ≥1:8.

Three types of vaccination program could be used for eradication or control of ND in Australia:

- reduction of virus production in large populations of poultry for which slaughter is delayed by shortage of resources, and/or provision of a barrier of immune birds to assist an area, and/or protection of particularly valuable or genetically important populations of birds
- compulsory vaccination in a defined area, together with movement restrictions, to prevent transmission of virulent virus, and thereby enable elimination of the virulent virus and any precursor strains
- voluntary vaccination after movement restrictions have been lifted, if it is decided that Australia should live with virulent ND virus because of an inability to control the disease.

Vaccination may mask clinical disease and should be considered when undertaking surveillance activities.

In choosing to use vaccination (with or without slaughter of known infected flocks – stamping out), an issue to be considered is the time required, according to the OIE rules, before ND-free status can be obtained for an affected country, zone or compartment. If stamping out and disinfection are used, this time is 3 months from the last occurrence of infection in poultry, provided that appropriate surveillance is carried out.

A stamping-out policy should be maintained for as long as possible. However, if an outbreak begins in a very large poultry farm and is known to have extended rapidly to other premises in an area with a dense poultry population, it may quickly become apparent that available resources are insufficient to prevent further rapid spread using only slaughter and disposal methods. In such a case, vaccination should be initiated to reduce virus production in exposed flocks on or around an IP, or to provide a barrier of immune birds by vaccinating in a ring around the RA. Stamping out could progress in line with industry practice if undertaken using strict standard operating procedures (SOPs) that include high-level biosecurity practices.

Flocks on the outer edge of the ring should be vaccinated first, in case the virus has already spread further than expected. If the aim is to protect valuable breeding flocks, these should be revaccinated first (currently, breeding flocks in all states and territories are vaccinated). Vaccinating flocks from the perimeter to the centre of a zone will allow vaccination teams to move from low-risk to high-risk flocks, thereby reducing the chance of inadvertently spreading the virulent virus (as happened in California in 1972). Wherever possible, farmers should carry out vaccinations.

In contrast, if an outbreak begins in an area where bird density is low – even if the IP is a very large farm – it would probably be practicable and more desirable to prevent spread and eradicate the disease using only quarantine and destruction of birds.

The V4 strain vaccine is nonpathogenic and immunogenic, giving protection to half the vaccinated chickens as early as 7 days after aerosol application. Vaccination may mask clinical disease, and surveillance methods to detect clinically infected flocks need to take this into account.

Breeding stock

Currently, all breeding stocks in all states and territories are vaccinated. Revaccination of flocks may be instituted in response to an outbreak.

Eggs from infected birds can be infected, but such eggs are likely to suffer early embryonic death and may be removed from the incubator on candling. It is also possible to sanitise the surfaces of eggs to reduce the transfer of ND virus during the hatching period.

Egg laying flocks

Currently all egg laying flocks in all states and territories are vaccinated. Revaccination of flocks may be instituted in response to an outbreak.

Meat birds (broilers)

Currently, all broiler flocks in Victoria and New South Wales are vaccinated. During an ND outbreak, these flocks might be revaccinated.

In other states and territories where broilers are not compulsorily vaccinated, vaccination may be instituted in response to an outbreak.

Where vaccine is used to establish a buffer of immune birds and the birds or premises do not become infected, the birds may be destroyed and marketed under controlled SOPs after a suitable time has elapsed.

See Section 2.7 for further details on vaccination, including vaccines available and methods of vaccination.

4.3.6 Treatment of infected animals

Treatment of birds with ND is ineffective and not appropriate.

4.3.7 Treatment of animal products and byproducts

Poultry products may need to be treated in certain circumstances. The treatment required will depend on the type of product, the nature of the declared area and the disease status of the premises. Stored and frozen products from SPs will not require treatment if the proper sanitisation procedures have been implemented, the premises has met flock inspection requirements and demonstrated negative serology, and the minimum incubation period has elapsed. All waste material must be decontaminated.

Cooked products must meet minimum time and temperature requirements during cooking, and must have been produced under SOPs for production, harvesting, processing and distribution. Care needs to be taken with flash-fried products (eg chicken nuggets for further cooking) that have not met these minimum requirements under normal processing; controlled distribution should ensure further cooking of these products (see Section 2.4.2).

Treatment of manure and litter on-site, or disposal after removal from the site, will require approval. Treatment and approval will depend on the disease status of the property.

4.3.8 Destruction of animals

Stamping out

All birds on an IP will be subject to stamping out. Decisions on the destruction of birds on other premises will be based on available information from tracing, surveillance and pathotyping of virus isolates.

Destruction methods

Efficient, humane procedures must be used to kill birds, preferably without moving them from the site. Methods include neck dislocation, decapitation, captive bolt or lethal injection for individual birds; and use of carbon dioxide or foam for destruction of flocks in situ. Some methods, such as ventilation shutdown, have significant negative animal welfare impacts and are not generally supported. Destruction methods are described in the **AUSVETPLAN operational manual *Destruction of animals***, and a decision-making guide is available in the **AUSVETPLAN resource document *Methods for the destruction of poultry, pet/zoo birds and aviary species***. Political, social, operational, technical and financial factors must be considered in determining the most appropriate destruction method.

The most appropriate method will depend on the species of bird, the premises type, the weather, the availability of trained personnel, the speed with which destruction is required and the available physical resources. Handling dead birds produces less airborne contamination than catching and handling live birds, reduces the exposure of workers to contamination and makes working in the recommended personal protective equipment more bearable. However, handling dead birds in cages while rigor mortis is present may create significant challenges in animal removal.

Airborne dispersal of virus should be minimised at all times by closing up bird houses, and shutting down fans or reducing their speed during depopulation. Depopulation activities should occur inside sheds as far as practicable. Infected or potentially infected birds should not be moved between sheds,

or carried outside to skips or containers, unless these are the only methods available for depopulation.

Disinfection of the litter surface, and containment of feathers, dander and so on will reduce the load of virus that can potentially be spread. Access of wild birds to premises containing domestic or zoo birds, especially commercial poultry, should be taken into account when deciding on the order in which to start depopulation operations.

4.3.9 Disposal of animals, and animal products and byproducts

One of the major objectives of the eradication program is prompt and effective disposal of contaminated material that cannot be effectively treated (eg dead birds, eggs, litter, manure, fresh or frozen carcases, plant and equipment, building materials).

Disposal may be either on or off the IP or DCP. The best method should be determined by risk assessment, taking into account factors such as the proximity to appropriate disposal sites, the risk of virus spread via transport, and the impact on businesses and the community. Most available methods of disposal are described in the **AUSVETPLAN operational manual *Disposal***. The most likely on-site disposal methods include composting and deep burial. Off-site disposal by burial at a common site, contained incineration, composting or rendering could be used if on-site disposal is not suitable or practical.

Wilkinson (2007) noted that composting is particularly suitable for dead poultry and litter on broiler farms, and that it can be conducted either inside or outside the poultry house. RIRDC (2014) described the process of composting for destruction of the V4 vaccine strain of ND virus, recommending a 14-day process with turning to ensure temperatures above 45 °C for a minimum of 24 hours in all parts of the compost.

If infected material must be transported for disposal, particular attention should be paid to preventing spread of the virus. For example, truck body trays must be leakproof, and all loads must be carefully covered with tarpaulins to ensure that material cannot blow out.

Disposal of large numbers of birds in a short time presents environmental and logistical problems. A poultry shed full of meat birds close to market weight contains about 75–90 tonnes of organic material, of which 75% is water.

4.3.10 Decontamination

Decontamination of premises, things and people is an essential part of the stamping-out policy and must be rigorously applied. Most ND virus is excreted from infected birds in faeces. The virus is relatively stable in faeces and litter, and anything contaminated with either of these materials can disseminate infection.

The virus is sensitive to ether, and is inactivated by formalin, phenolics, oxidising agents (eg sodium hypochlorite), chlorhexidine, acids with pH ≤2, and alkalis such as sodium hydroxide and sodium carbonate anhydrous (FAO 2001, OIE 2019).

Decontamination entails cleaning and disinfection of the IP to remove all infective material. ND virus is susceptible to a wide range of disinfectants, particularly those with detergents, but only if items are properly cleaned before being disinfected. Initial cleaning of organic matter from sheds, equipment, vehicles and so on by brushing and washing with a detergent is the most important step before disinfection.

Disinfection of litter, such as feathers, faeces and bedding, is extremely important during an outbreak.

The quantity of disinfectant to be used in an outbreak will usually be several times greater than that used in routine disinfection procedures. Particular attention should be paid to decontamination of litter. Since ND virus can survive up to 53 days in litter material and 255 days on feathers, it is necessary to quickly disinfect the surface of the litter and adopt measures such as composting to thermally inactivate the virus. Because most disinfectants are inactivated by organic material, contaminated litter may have to be buried or burned after surface disinfection if temperatures are not sufficiently high for long enough (eg 45 °C for 24 hours or 55 °C for shorter periods) in the composting process.

Following initial cleaning and disinfection of surfaces, the high daily temperatures and low humidity experienced in some areas of Australia during summer can be used to inactivate infectious agents. In the 1998 ND outbreak, an IP was left for 6 months to decontaminate after a high-pressure wash-down.

Equipment and fixtures should be dismantled, handwashed and disinfected, rather than cleaned and disinfected in situ by use of high-pressure water or steam hoses, unless they can then be left for 6 months. Fomites, such as clothing, footwear, crates, feed sacks and egg fillers, should also be disinfected, if possible, or destroyed.

Sheds, yards, rendering plants, their surroundings, and burial and burning grounds should be decontaminated as soon as possible.

On an IP, any feed that has had direct contact with birds should be securely disposed of or destroyed in an approved manner. Feed stored in closed silos and not in direct contact with birds should be subject to a risk assessment to determine whether it should be destroyed or contained.

For further information, see the **AUSVETPLAN operational manual *Decontamination***.

4.3.11 Wild animal management

In five outbreaks of virulent avian influenza and numerous outbreaks of virulent ND in 1930, 1932 and 1998–2002 in Australia, wild birds were not proven to be infected. Wild birds that visit poultry sheds may harbour and shed ND virus or spread the virus mechanically. Overseas, they have been implicated as the initial cause of exotic ND outbreaks. However, they appear to play little part in the spread of disease between flocks during an outbreak. Compartmentalisation (according to OIE requirements) of bird populations in countries and zones into domestic and free-living birds ensures that, even if the virus establishes in free-living birds, the infection status of commercial poultry will not be affected until infection occurs in that compartment.

To minimise the risk from wild birds, high-level biosecurity is essential. Bird-proofing of quarantined and other poultry houses, and protection of contaminated sites from birds during eradication procedures are essential disease control strategies and need to be rigorously enforced.

Control and destruction of rats and mice are also important because they can act as mechanical carriers. For further information, see the **AUSVETPLAN operational manual *Wild animal response strategy***.

Other birds

After notification of a suspected outbreak, it may be necessary to ban pigeon-racing activities, bird shows, and local sales and markets in the RA and CA. Racing pigeons have been a source of virus in other countries. However, the outbreaks associated with pigeons were of a particular strain of ND virus that was transmitted to commercial poultry after prepared poultry feeds were contaminated by feral pigeons.

Particular attention must be paid to workers on IPs who keep poultry at home. Destruction or vaccination of such birds as soon as possible is advisable, even if they are ornamental birds or pets. Pet birds linked to DCPs and SPs should be quarantined and kept under surveillance, with or without vaccination.

4.3.12 Vector management

Decontamination should include control of insect vectors and rodents to minimise mechanical spread of ND virus to nearby premises. The control of vermin should meet the high standards expected on a commercial poultry farm.

Flying insects can spread the disease mechanically (see Section 2.4.2). If practical and appropriate, steps should be taken to reduce the numbers of flying insects and minimise the chance of flies entering bird sheds.

4.3.13 Public awareness and media

The **Biosecurity Incident Public Information Manual**[12] provides a guide for undertaking activities associated with public information management.

Details on enhancing farm biosecurity practices and practising good biosecurity are available in the biosecurity manuals available on the Farm Biosecurity website.[13]

In addition to biosecurity messaging, a media campaign must emphasise the importance of poultry producers, bird owners and zoo personnel inspecting susceptible animals regularly, and reporting suspicious clinical signs and unusual deaths promptly.

12 animalhealthaustralia.com.au/ausvetplan

13 www.farmbiosecurity.com.au

Details of any imposed movement controls (Section 6) need to be made available, clearly explained and understood.

Although human infection with ND can occur occupationally, there is no established risk to the public from poultry products (see Section 2.4.2). Good communications can do much to ensure that the market for poultry products stays strong during an ND response. Information must be provided to the public to address concerns about the safety of poultry products.

4.3.14 Other strategies

Restocking of flocks or areas should be undertaken after a risk assessment and consideration of the epidemiological situation. No restocking should take place before the outbreak has been brought under control in the area where infection was widespread.

Before full repopulation, sentinel birds should be used to determine the effectiveness of decontamination measures. This approach will delay full repopulation, but has the advantage of avoiding the costs that would result if a fully restocked premises became infected as a result of inadequate decontamination.

It is vital that sentinel birds have ample opportunity to be exposed to ND virus should it remain in the decontaminated area. In cage layer operations, this may require allowing access of sentinel birds to cages, the floor and manure collection areas. In free-range operations, access to all production and housing areas (eg laying areas, feeders, night housing) must be allowed.

When determining the time between decontamination and restocking of premises with sentinels or full repopulation, virus survivability outside the host (see Section 2.4.2) should be considered. This will take into account factors influencing virus survivability, including temperature, humidity, salinity, pH, surface type, ultraviolet light and chemical application. Economic and social factors associated with delayed recommencement of business operations should also be considered.

Historically, restocking of premises with sentinel birds or full repopulation has not been allowed until at least 21 days following cleaning and disinfection. The basis for this is unclear because limited information is available on virus survivability on surfaces that are likely to be found in poultry sheds. However, survival of virus in dust in poultry houses has been reported for 2–5 weeks after depopulation (Webster et al 1978). Longer periods for restocking of IPs and DCPs may be appropriate, and may be informed through risk assessment.

Methods of lowering the risk of infection in restocked populations that have been used successfully in overseas outbreaks include an extended period (60 days) after cleaning and disinfection, with no sentinel birds; dead bird sampling of repopulated flocks; and the use of unvaccinated birds as sentinels in vaccinated flocks.

4.4 Funding and compensation

Details of the cost-sharing arrangements can be found in the Government and Livestock Industry Cost Sharing Deed in Respect of Emergency Animal Disease Responses.[14] Details of the approach to the valuation of, and compensation for, livestock and property in disease responses can be found in the **AUSVETPLAN operational manual *Valuation and compensation***.

14 www.animalhealthaustralia.com.au/eadra

5 Declared areas and premises

When an emergency animal disease (EAD) is first suspected, the premises involved would undergo a clinical and/or epidemiological investigation. If the case definition, as defined in the relevant AUSVETPLAN response strategy, is met (ie the index case[15]), the relevant chief veterinary officer (CVO) or their delegate will determine the premises classification and may declare the premises an infected premises (IP).

After the identification of the first IP, a restricted area (RA) and a control area (CA) may be declared.[16] A transmission area (TA) may also be defined, if appropriate. All premises within these areas will be classified.

At the beginning of an EAD incident, the initial premises classifications would be IP, at-risk premises (ARP), premises of relevance (POR), unknown status premises (UP) and zero susceptible species premises (ZP).

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

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

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

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

15 The first case to come to the attention of investigators

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

5.1 Declared areas

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

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

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

5.1.1 Restricted area (RA)

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

An RA will be a relatively small declared area[17] (compared with a CA) drawn with at least 1-5 km radius around all IPs and DCPs, and including as many SPs, TPs and DCPFs as practicable. Based on risk assessment, the RA is subject to intense surveillance and movement controls. The purpose of the RA is to minimise the spread of the EAD. The RA does not need to be circular but can have an irregular perimeter, provided that the boundary is initially an appropriate distance from the nearest IP, DCP, DCPF, SP or TP. Multiple RAs may exist within one CA.

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

5.1.2 Control area (CA)

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

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

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

17 As defined under relevant jurisdictional legislation

The CA will be a larger declared area around the RA(s) – initially, possibly as large as the state or territory in which the incident occurs – where restrictions will reduce the risk of disease spreading from the RA(s). The CA will have a minimum radius of 2-10 km, encompassing the RA(s). It may be defined according to geography, climate and the distribution of relevant wild (including feral) animals. The boundary will be adjusted as confidence about the extent and distribution of the incident increases.

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

5.2 Other areas

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

Disease-susceptible animals and their products may be allowed to move within and out of the control area with a permit.

5.3 Premises classifications

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

5.3.1 Premises status classifications

For Newcastle disease (ND), the premises classifications to be used are:

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

5.3.2 Qualifiers

Please also refer to the **AUSVETPLAN guidance document *Declared areas and application of premises classifications in an EAD response*** for more detail on qualifiers.

For Newcastle disease (ND), the qualifiers to be used are:

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

5.4 Reclassifying premises and previously declared areas

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

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

5.4.1 Reclassifying previously declared areas

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

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

- The area should be epidemiologically distinct from other declared areas.
- All TPs and SPs have been investigated and reclassified, and all IPs, DCPs and DCPFs in the area have been reclassified as RPs (or APFs).
- All tracing and surveillance associated with EAD control has been completed satisfactorily, with no evidence or suspicion of infection in the area.
- A minimum period of 42 days[18] has elapsed since predetermined disease control activities and risk assessment were completed on the last IP or DCP in the area or a risk assessment supports reclassification.
- An approved surveillance program (including the use of sentinel animals, if appropriate) has confirmed no evidence of infection in the RA (see below).
- For vector-borne diseases, vector monitoring and absence of transmission studies indicate that vectors are not active.

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

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

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

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

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

6 Movement controls

6.1 Principles

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

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

6.2 Guidelines for issuing permits

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

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

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

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

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

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

6.3 Types of permits

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

General permit

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

Special permit

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

Emergency permit

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

Other movement requests

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

6.4 Recommended movement controls

Refer to the **AUSVETPLAN enterprise manual *Poultry industry*** (chickens, ducks and turkeys) for detailed industry information.

Movement controls are commensurate with the determined risk, taking into account the need to minimise impacts on business continuity, and return to normal business and trade as soon as possible.

Refer to Appendix 2 for movement permit conditions.

6.4.1 Live susceptible animals

All movements of live birds and bird products off infected premises (IPs), dangerous contact premises (DCPs), SPs and TPs are prohibited.

The status of TPs and SPs must be resolved before movement permits for birds or bird products can be applied for.

Where possible, RAs should not include hatcheries. Repopulation assessment will occur once the RA has been resolved into a CA.

For movements from OA to OA, company records must be kept and made available for inspection if required.

Premises other than IPs, DCPs, SPs and TPs

Table 6.1 shows the recommended movement controls for live day-old chicks on premises other than IPs, DCPs, SPs and TPs for farm-to-farm movement other than slaughter.

Table 6.1 Recommended movement controls for live susceptible animals not being sent to slaughter (other than from IPs, DCPs, SPs and TPs)

To → / From ↓	RA	CA	OA
RA	Prohibited	Prohibited	Prohibited
CA	Prohibited	Prohibited, except under SpP – conditions 1, 2, 3, 4, 5, 6, 9, 32	Prohibited, except under SpP – conditions 1, 2, 3, 4, 5, 6, 8
OA	Prohibited	Prohibited, except under GP[a] – condition 7	Allowed under normal jurisdictional (including interstate) requirements

CA = control area; GP = general permit; OA = outside area; RA = restricted area; SpP = special permit

a Company records must be kept and made available for inspection if required.

Table 6.2 shows the recommended movement controls for other poultry from premises other than IPs, DCPs, SPs and TPs for farm-to-farm movement other than slaughter. This includes movement of pullets to layer farms, and pullets from breeder rearers to breeder producers; live bird sales to backyard or hobby farms, auctions, markets and so on; and 'brood and move' in breeder and broiler farm operations.

Table 6.2 Recommended movement controls for live birds other than day-old chicks from premises other than IPs, DCPs, SPs and TPs

To → / From ↓	RA	CA	OA
RA	Prohibited[a]	Prohibited[a]	Prohibited[a]
CA	Prohibited[a]	Prohibited, except under SpP – conditions 2, 5, 6, 8	Prohibited, except under SpP – conditions 2, 5, 6, 8
OA	Prohibited[a]	Prohibited, except under GP – condition 8	Allowed under normal jurisdictional (including interstate) requirements

CA = control area; GP = general permit; OA = outside area; RA = restricted area; SpP = special permit

a Although movement of live birds between farms is prohibited, these birds may:

– be allowed to move to slaughter (see Table 6.4)

– remain on farm if welfare conditions can be met, provided biosecurity risks do not increase

– be destroyed.

Table 6.3 shows the recommended movement controls for live birds to slaughter from premises other than IPs, DCPs, SPs and TPs. This includes meat birds, spent hens and breeders for human consumption, including emergency process slaughtering.

Table 6.3 Recommended movement controls for live birds to slaughter from premises other than IPs, DCPs, SPs and TPs

To → / From ↓	RA	CA	OA
RA	Prohibited, except under SpP[a] — conditions 2, 5, 6, 8, 11, 12, 15, 18	Prohibited, except under SpP[a] — conditions 2, 5, 6, 8, 11, 12, 15, 18	Prohibited, except under SpP[a] — conditions 2, 5, 6, 8, 11, 12, 15, 18[a]
CA	Prohibited, except under SpP[a] – conditions 2, 5, 6, 8, 11, 15, 19	Prohibited, except under SpP[a] — conditions 2, 5, 6, 8, 11, 15	Prohibited, except under SpP[a] – conditions 2, 5, 6, 8, 11, 15
OA	Prohibited, except under SpP – conditions 2, 5, 6, 8, 11, 15, 19	Prohibited, except under GP – conditions 2, 5, 6, 8, 11, 20	Allowed under normal jurisdictional (including interstate) requirements

CA = control area; GP = general permit; OA = outside area; RA = restricted area; SpP = special permit

a See also permit conditions for movement of meat and meat products (Section 6.4.3) and other animal byproducts (Section 6.4.5) for restrictions that may apply post-slaughter.

Other susceptible species

Other susceptible species (eg birds other than the principle farm species) should not be moved from IPs, DCPs, SPs and TPs without risk assessment, and the issue of an appropriate permit.

Nonsusceptible species

Nonsusceptible species should be prevented from coming into proximity with poultry facilities. They should not be moved from IPs, DCPs, SPs and TPs without risk assessment, and the issue of an appropriate permit.

Those involved in feed and other essential deliveries (eg water, gas, diesel) to declared premises, including IPs, TPs, SPs and DCPs, must follow conditions 58 and 60 in Appendix 2.

6.4.2 Carcasses

IPs, DCPs, SPs and TPs

Table 6.4 shows the recommended movement controls for dead (whole) birds on IPs and DCPs for disposal (burial, rendering, composting or incineration).

TPs and SPs will need to be resolved before a movement permit can be considered and issued.

Table 6.4 Recommended movement controls for dead birds to disposal from IPs and DCPs

To → / From ↓	RA	CA	OA
IP/DCP	Prohibited, except under SpP — conditions 6, 8, 21, 22, 23, 24, 60	Prohibited	Prohibited

CA = control area; DCP = dangerous contact premises; IP = infected premises; OA = outside area; RA = restricted area; SpP = special permit

Premises other than IPs, DCPs, SPs and TPs

Table 6.5 shows the recommended movement controls for dead (whole) birds on premises other than IPs, DCPs, SPs and TPs for disposal (burial, rendering, composting or incineration). This includes hatchery culls, zoo food and balut eggs.

Table 6.5 Recommended movement controls for dead birds to disposal from premises other than IPs, DCPs, SPs and TPs

To → / From ↓	RA	CA	OA
RA	Prohibited, except under SpP — conditions 6, 21, 22, 23, 24, 25, 26, 27	Prohibited, except under SpP[a] — conditions 6, 21, 22, 23, 24, 25, 26, 27	Prohibited
CA	Prohibited, except under SpP — conditions 6, 21, 22, 23, 24, 25, 26, 27	Prohibited, except under SpP — conditions 6, 21, 22, 23, 24, 25, 26, 27	Prohibited
OA	Prohibited, except under GP[b] — condition 28	Prohibited, except under GP[b] — condition 28	Allowed under GP[b] — condition 28

CA = control area; GP = general permit OA = outside area; RA = restricted area; SpP = special permit

a Not the preferred approach but can be considered if no other option following risk assessment (decision to be made on a case-by-case basis)

b Not the preferred option for disposal of dead birds from OA

6.4.3 Meat and meat products

Premises other than IPs, DCPs, SPs and TPs

Table 6.6 shows the recommended movement controls for meat and meat products on premises other than IPs, DCPs, SPs and TPs, from which movement is prohibited. This includes meat, whole birds and all other products recovered from the processing plant (eg offal, feet, tongues, oviducts, ova, frames, bones, pluck) for retail or further processing into products for human consumption or pet food.

Table 6.6 Recommended movement controls for meat and meat products from premises other than IPs, DCPs, SPs and TPs

To → / From ↓	RA	CA	OA
RA	Prohibited, except under SpP - conditions 13, 29, 66	Prohibited, except under SpP - conditions 29, 66	Prohibited, except under SpP - conditions 29, 66
CA	Allowed (under normal jurisdictional, including inter-state, requirements)	Allowed (under normal jurisdictional, including inter-state, requirements)	Prohibited, except under GP - condition 29
OA	Allowed (under normal jurisdictional, including inter-state, requirements)	Allowed (under normal jurisdictional, including inter-state, requirements)	Allowed (under normal jurisdictional, including inter-state, requirements)

CA = control area; OA = outside area; RA = restricted area; SpP = special permit

There are strict movement controls for poultry products during an outbreak.

6.4.4 Eggs and egg products

Eggs and egg products on IPs, DCPs, SPs and TPs for disposal

Table 6.7 shows the recommended movement controls for eggs and egg products on IPs and DCPs going for disposal.

TPs and SPs must be resolved before a movement permit can be considered and issued.

Table 6.7 Movement of eggs and egg products for disposal from IPs and DCPs

To → / From ↓	RA	CA	OA
IP/DCP	Prohibited, except under SpP[a] — conditions 6, 8, 21, 22, 23, 30, 36, 58, 60, 61	Prohibited	Prohibited

a Movement from an IP or DCP is not the preferred option. Movement permits will be considered on a case-by-case basis after risk assessment.

Eggs to hatchery or pulping

IPs, DCPs, SPs and TPs

Table 6.8 shows the recommended movement controls for eggs and egg products on IPs and DCPs going for pulping and pasteurisation for human consumption.

Movement of eggs from IPs and DCPs to hatchery is prohibited.

TPs and SPs must be resolved before a movement permit can be considered and issued.

Table 6.8 Recommended movement controls for eggs and egg products on IPs and DCPs going for pulping and pasteurisation

To → / From ↓	RA	CA	OA
IP/DCP	Prohibited, except under SpP[a] — conditions 6, 8, 21, 22, 23, 30, 36, 39, 58, 60, 61	Prohibited	Prohibited

CA = control area; DCP = dangerous contact premises; IP = infected premises; OA = outside area; RA = restricted area; SpP = special permit

a Movement from an IP or DCP is not the preferred option. Movement permits will be considered on a case-by-case basis after risk assessment.

Premises other than IPs, DCPs, SPs and TPs

Table 6.9 shows the recommended movement controls for fertile eggs to hatchery or pulping (commercial food production) from premises other than IPs, DCPs, SPs and TPs.

Table 6.9 Recommended movement controls for fertile eggs to hatchery or pulping from premises other than IPs, DCPs, SPs or TPs

To → / From ↓	RA	CA	OA
RA	Prohibited	Prohibited, except under SpP - conditions 5, 6, 8, 11, 12, 14, 31, 36, 37, 58, 60, 62, 64, 65	Prohibited, except under SpP - conditions 5, 6, 8, 11, 12, 14, 31, 36, 37, 58, 60, 62, 64, 65
CA	Prohibited	Prohibited, except under GP – conditions 5, 8, 11, 31, 36, 37	Prohibited, except under GP – conditions 5, 8, 11, 31, 36, 37
OA	Prohibited	Prohibited, except under GP – conditions 5, 8, 11, 31, 36, 37	Allowed (under normal jurisdictional, including inter-state, requirements)

CA = control area; DCP = dangerous contact premises; GP = general permit; IP = infected premises; OA = outside area; RA = restricted area; SP = suspect premises; SpP = special permit; TP = trace premises

Table (shell) eggs to grading or processing facilities from premises other than IPs, DCPs, SPs and TPs

Table 6.10 shows the recommended movement controls for table (shell) eggs to grading facilities or processing facilities from premises other than IPs, DCPs, SPs and TPs. This may include eggs from breeders.

Table 6.10 Recommended movement controls for table (shell) eggs to grading or processing facilities from premises other than IPs, DCPs, SPs or TPs

To → / From ↓	RA	CA	OA
RA	Prohibited, except under SpP — conditions 2, 8, 34, 35, 36, 37, 38, 39, 40, 43	Prohibited, except under SpP — conditions 2, 8, 34, 35, 36, 37, 38, 39, 40, 43	Prohibited, except under SpP — conditions 2, 8, 34, 35, 36, 37, 38, 39, 40, 43
CA	Prohibited, except under GP — conditions 8, 41	Allowed (under normal jurisdictional, including inter-state, requirements)	Prohibited, except under GP — condition 41
OA	Prohibited, except under GP — conditions 8, 41	Allowed (under normal jurisdictional, including inter-state, requirements)	Allowed (under normal jurisdictional, including inter-state, requirements)

CA = control area; GP = general permit; OA = outside area; RA = restricted area; SpP = special permit

Table eggs from grading facilities (other than IPs, DCPs, SPs and TPs) to retail or processing (pulping)

Table 6.11 shows the recommended movement controls for table (shell) eggs from grading facilities (other than IPs, DCPs, SPs and TPs) to retail or processing (pulping).

Table 6.11 Recommended movement controls for table (shell) eggs from grading facilities to retail or processing (pulping)

To → / From ↓	RA	CA	OA
RA	Prohibited, except under GP — conditions 39, 41, 43, 44, 58	Prohibited, except under GP — conditions 41, 42	Prohibited, except under GP — conditions 41, 42
CA	Prohibited, except under GP — conditions 41, 42	Prohibited, except under GP — conditions 41, 42	Prohibited, except under GP — conditions 41, 42
OA	Prohibited, except under GP — conditions 41, 42	Prohibited, except under GP — conditions 41, 42	Allowed (under normal jurisdictional, including inter-state, requirements)

CA = control area; GP = general permit; OA = outside area; RA = restricted area; SpP = special permit

Fertile eggs to hatchery

Table 6.12 shows the recommended movement controls for fertile eggs to hatchery.

Table 6.12 Recommended movement controls for fertile eggs to hatchery

To → / From ↓	RA	CA	OA
RA	Prohibited, except under GP — conditions 39, 41, 43, 44, 58	Prohibited, except under GP — conditions 41, 42	Prohibited, except under GP — conditions 41, 42
CA	Prohibited, except under GP — conditions 41, 42	Prohibited, except under GP — conditions 41, 42	Prohibited, except under GP — conditions 41, 42
OA	Prohibited, except under GP — conditions 41, 42	Prohibited, except under GP — conditions 41, 42	Allowed (under normal jurisdictional, including inter-state, requirements)

CA = control area; GP = general permit; OA = outside area; RA = restricted area; SpP = special permit

Fertile eggs for research or vaccine production

The following criteria need to be met at the point of origin (nucleus stock supplier, specific pathogen–free egg supplier, research farm, commercial supplier) for fertile eggs being used for research or vaccine production, or going to diagnostic testing facilities:

- no evidence of disease on the property of origin
- biosecure facility
- biosecure transport
- handling and storage of eggs in a biosecure manner.

The decision to permit movements will be made on a case-by-case basis using a thorough risk assessment.

6.4.5 Other animal byproducts

Premises other than IPs, DCPs, SPs and TPs

Table 6.13 shows the recommended movement controls for byproducts from processing plants on premises other than IPs, DCPs, SPs and TPs. Byproducts include offal, feathers, blood, off-cuts, fat, frames, bones, trim, downgrades and so on that are not fit for human consumption and are being transported to rendering plants.

Table 6.13 Recommended movement controls for byproducts from processing plants on premises other than IPs, DCPs, SPs and TPs

To → / From ↓	RA	CA	OA
RA	Prohibited, except under SpP — conditions 6, 8, 21, 24, 45, 46, 47	Prohibited, except under SpP — conditions 6, 21, 24, 45, 46, 47, 48	Prohibited, except under SpP — conditions 6, 21, 24, 45, 46, 47, 48
CA	Prohibited, except under SpP — conditions 6, 21, 24, 45, 46, 47, 48, 49	Allowed (under normal jurisdictional, including inter-state, requirements)	Allowed (under normal jurisdictional, including inter-state, requirements)
OA	Allowed (under normal jurisdictional, including inter-state, requirements)	Allowed (under normal jurisdictional, including inter-state, requirements)	Allowed (under normal jurisdictional, including inter-state, requirements)

CA = control area; OA = outside area; RA = restricted area; SpP = special permit

Table 6.14 shows the recommended movement controls for byproducts from rendering plants on premises other than IPs, DCPs, SPs and TPs. These byproducts include meatmeal, feathermeal, bloodmeal and tallow.

Table 6.14 Recommended movement controls for byproducts from rendering plants on premises other than IPs, DCPs, SPs and TPs

To → / From ↓	RA	CA	OA
RA	Prohibited, except under SpP - condition 49	Prohibited, except under SpP - condition 49	Prohibited, except under SpP - condition 49
CA	Allowed (under normal jurisdictional, including inter-state, requirements)	Allowed (under normal jurisdictional, including inter-state, requirements)	Allowed (under normal jurisdictional, including inter-state, requirements)
OA	Allowed (under normal jurisdictional, including inter-state, requirements)	Allowed (under normal jurisdictional, including inter-state, requirements)	Allowed (under normal jurisdictional, including inter-state, requirements)

CA = control area; OA = outside area; RA = restricted area; SpP = special permit

6.4.6 Waste products and effluent

IPs, DCPs, TPs and SPs

Table 6.15 shows the recommended movement controls for manure and used litter (and other waste products, including hatchery waste, processing plant waste, contaminated packaging waste and egg processing waste) from IPs and DCPs.

SPs and TPs must be resolved before a movement permit can be considered and issued.

Table 6.15 Recommended movement controls for manure, used litter and other waste products from IPs and DCPs

To → / From ↓	RA	CA	OA
IP/DCP	Prohibited, except under SpP — conditions 6, 8, 21, 22, 23, 24, 52, 53, 60	Prohibited	Prohibited

CA = control area; DCP = dangerous contact premises; IP = infected premises; OA = outside area; RA = restricted area; SpP = special permit

At-risk premises (ARPs)

Table 6.16 shows the recommended movement controls for manure and litter from at-risk premises (ARPs).

Table 6.16 Recommended movement controls for manure and litter from ARPs

To → / From ↓	RA	CA	OA
ARP	Prohibited, except under SpP – conditions 2, 5, 6, 8, 11, 12, 21, 22, 23, 24, 28, 52, 53, 58	Prohibited, except under SpP – conditions 2, 5, 6, 8, 11, 12, 21, 22, 23, 24, 28, 52, 53, 58	Prohibited, except under SpP – conditions 2, 5, 6, 8, 11, 12, 21, 22, 23, 24, 28, 52, 53, 58

ARP = at-risk premises; CA = control area; OA = outside area; RA = restricted area; SpP = special permit

Premises other than IPs, DCPs, SPs, ARPs and TPs

Table 6.17 shows the recommended movement controls for waste products on premises other than IPs, DCPs, SPs, TPs and ARPs. Waste includes hatchery waste, processing plant waste, contaminated packaging waste, egg processing waste, litter and manure.

Table 6.17 Recommended movement controls for waste products on premises other than IPs, DCPs, SPs, TPs and ARPs

To → / From ↓	RA	CA	OA
RA	Prohibited, except under SpP — conditions 6, 21, 23, 24, 45, 50, 51	Prohibited, except under SpP — conditions 6, 21, 23, 24, 45, 50, 51	Prohibited, except under SpP[a] — conditions 6, 21, 23, 24, 45, 50, 51
CA	Prohibited, except under SpP — conditions 6, 21, 23, 24, 45, 50, 51	Prohibited, except under GP — condition 28	Prohibited, except under GP — condition 28
OA	Prohibited, except under SpP — conditions 6, 21, 23, 24, 45, 50, 51	Prohibited, except under GP[b] — condition 28	Allowed (under normal jurisdictional, including inter-state, requirements)

CA = control area; GP = general permit; OA = outside area; RA = restricted area; SpP = special permit

a Not the preferred approach but can be considered if no other option following risk assessment (decision to be made on a case-by-case basis)

b Not the preferred option for disposal of waste from OA

6.4.7 Vehicles, including empty livestock transport vehicles and associated equipment

Vehicles and equipment that have had direct contact with susceptible animals, their products or wastes (eg potentially contaminated mud):

- Movement off quarantined premises (IPs, SPs, TPs, DCPs and DCPFs) and other premises in the RA is prohibited, except when subject to risk assessment on a case-by-case basis. Where movements are allowed under SpP, the vehicles and equipment must be decontaminated before and after use at an appropriate site under the supervision of an authorised government officer. If decontamination of equipment is not practicable, it should be disposed of appropriately (see Section 4.3.9).
- Movement off other premises in the CA is prohibited, except under GP, with the conditions that the vehicles and equipment must be decontaminated before and after use at an appropriate site (eg truck wash-down facility at an abattoir) using a protocol provided by the response authority, and records must be kept of the movement and decontamination protocol used.
- Movement off premises in the OA is allowed.

Other vehicles and equipment:

- Movement onto or off quarantined premises (IPs, SPs, TPs, DCPs and DCPFs) is prohibited, except when subject to risk assessment on a case-by-case basis. If the risk assessment concludes that the vehicle or equipment may potentially be contaminated with ND virus, they must be appropriately decontaminated or disposed of (see Sections 4.3.9 and 4.3.10).
- Movement onto or off other premises with susceptible animals in an RA or CA should be discouraged. Regular, routine vehicle movements onto farms, such as those for fodder deliveries and milk pick-ups, require particular attention, because of the essential nature of these movements, their frequency and the risk that they may present.
- Movement onto or off other premises in OA is allowed.

On leaving an RA, all vehicles will be subject to inspection and may undergo a decontamination process, if warranted.

6.4.8 Nonsusceptible animals

Where nonsusceptible animals could act as mechanical vectors for ND virus – for example, on IPs, DCPs, SPs and TPs – appropriate decontamination measures should be implemented.

Unnecessary movements of nonsusceptible animals onto and off premises with susceptible animals in RAs should be discouraged.

Nonsusceptible species should be prevented from coming into proximity with poultry facilities. They should not be moved from IPs, DCPs, SPs and TPs without risk assessment and the issue of an appropriate permit.

6.4.9 People

Movement controls should not hinder movements of the general public. However, where humans could act as mechanical vectors for ND virus – for example, on IPs, DCPs, SPs and TPs – appropriate decontamination measures should be implemented.

Unnecessary movements of people onto and off premises with susceptible animals in RAs should be discouraged.

Within the RA, people who regularly travel from farm to farm and come into contact with susceptible animals will be required to undergo appropriate decontamination of themselves, and their outer wear, equipment and vehicles between properties, and keep detailed records of their movements. They will be required to follow biosecurity controls at each premises they visit.

People involved in feed and other essential deliveries (eg water, gas, diesel) to declared premises, including IPs, TPs, SPs and DCPs, must comply with the following conditions:

- Driver should not exit the cabin of the truck.
- Driver should not have contact with poultry.
- Driver and cab are decontaminated if the driver exits the truck on a declared premises (both cab and driver are decontaminated before the driver re-enters the cab).

Movements on premises other than SPs and TPs within the CA and OA will not be restricted.

6.4.10 Crops, grains, hay, silage and mixed feeds

Crops, grains, hay and silage harvested from paddocks that were sprayed or treated with effluent on an IP or DCP, or mixed feeds made from such constituents, are not permitted to be moved off-site until the premises is declared free from ND and appropriate decontamination has occurred.[19] Other crops and grains may be removed from IPs and DCPs after the material has been decontaminated, and moved to other premises in either the RA or the CA, provided that the vehicle movement requirements are observed.

Movements of feeds onto IPs and DCPs may be necessary for animal welfare reasons; these would be permitted from low-risk premises or premises in the OA, provided that the vehicle movement requirements are observed.

Crops and grains from premises not associated with an IP or DCP have no movement restrictions.

Other feed movements that have, or may have, an association with an IP or DCP will be risk assessed on a case-by-case basis.

Risk management of stored feed

In assessing the potential disease risk from feed stored in silos or trucks on a feed mill premises associated with IPs or DCPs, the likelihood of contamination of feed must be considered.

Sources of contamination include:

- dust
- aerosols
- movement of infected or potentially infected birds from sheds, resulting in virus aerosolisation, or windborne spread of dust or feathers
- eggs (potential for virus transmission via direct or indirect contact)
- handling or removal of manure, resulting in windborne spread of dust
- contamination from fomites
- human movements – cross-contamination can be minimised by biosecurity practices, including the use of dedicated staff for various elements of the farm (eg poultry sheds, feed mill operations)
- mechanical transmission by animals (eg dogs, cats, rodents, wild birds) or insects (eg flies), or contamination by infected wild birds.

19 This will be informed through risk assessment, taking into account environmental conditions, including ambient temperature and humidity.

In assessing the potential disease risk from feed stored in silos or trucks on IPs or DCPs (but not in a feed mill), the likelihood of feed contamination by the following means must be considered:

- feed delivered from the feed mill that is already contaminated with ND virus through mechanisms described above
- introduction of the virus into the silos or trucks during loading of the feed where the virus source is from items noted above
- introduction of virus following loading of silos or trucks that are not fully sealed.

Storage conditions (eg time, temperature, location, security) and treatments (eg fumigation, pelleting, acidifying) will affect the viability of the virus in stored contaminated feed.

The impact of spread of ND virus via contaminated feed should also be considered, taking into account the proposed use (eg feeding to poultry on other farms or restocked populations; feeding to other species, such as pigs) or fate (eg disposal) of the feed. Where the feed is to be disposed of, consideration must be given to disposal procedures, and time and exposure pathways that may be created during disposal. For example, feed to be buried may remain uncovered for several hours, with access by wild birds.

6.4.11 Sales, shows and other events

All sales, shows and other events involving live susceptible animals within the RA are prohibited.

Events such as sales and shows in the CA and OA may proceed at the discretion of the relevant jurisdictional CVO, unless the risk associated with such events is deemed unacceptable within the response.

People movements for such sales, shows and events should be in accordance with Section 6.4.9.

7 Surveillance and proof of freedom

7.1 Surveillance

Surveillance is an essential tool for achieving eradication of Newcastle disease (ND) and ensuring freedom from the disease.

There are two phases of surveillance:

- early in an outbreak, to define the extent of infection
- following use of vaccination, to provide proof of eradication.

The purpose of surveillance is to identify potential new cases. Because of the risk of spread of virus by personnel, equipment, vehicles and other means, the following procedures should be adopted to enable continuing surveillance while minimising multiple farm visits to premises in the restricted area (RA) and control area (CA) by inspectors and industry personnel:

- biosecure procedures for dead bird collection and transport to a laboratory, or sampling for virology and sending to a laboratory (see Section 2.5.5)
- reporting on flock health and production statistics by telephone, email or fax
- adopting telephone or email surveying, where practicable to obtain meaningful results
- serological testing for evidence of ND flock exposure and immunity levels (if vaccinating)
- arranging visits only to potential new cases identified by the above methods.

Non-poultry flocks in the RA and CA should also be considered for surveillance.

Staff visits to premises – which do not necessarily require entry to the premises – are still valuable to enable discussions about flock health and biosecurity measures. Random visits by surveillance officers provide assurance to the industry about the integrity of a control strategy. The focus of surveillance should be on higher-risk and higher-density commercial poultry operations.

In planning a surveillance program, it is important to first identify all premises with poultry and the types of poultry on the premises.

Surveillance officers must:

- be familiar with the poultry industry; or
- pass information to poultry industry experts for interpretation.

Surveillance officers must have access to:

- standard flock health records (eg body weight gain/age, egg production rate/age, hatchability rate) expected for the class of stock under normal circumstances
- a summary of the disease – a list, pictures and video of clinical and pathological signs, and an example of how health and production records would change in flocks infected with virulent ND virus.

Information required

Information will be required from high-risk flocks in the RA and CA. Where the disease has spread, information will need to be collected from a wider area. The high-risk flocks might be those listed in Table 7.1.

Table 7.1 High risk flocks to be considered for surveillance

Commercial poultry	Domestic noncommercial birds	Other
Layers, free range	Pigeons (in lofts)	Backyard (mixed species)
Layers, caged and cage-free in closed sheds	Aviaries (parrots, parakeets)	Fancy breeders
Mixed layers, free range, cage-free and caged	Game birds	Zoo birds
Broilers, free range	Pet shop birds	Feral pigeons
Broilers in closed sheds		
Starter pullets		
Breeders (layers or broilers)		
Ducks and geese		
Turkeys		

A reporting procedure, which includes the following observations, should be adopted.

Examination of flock records provided by owners and by interviews of owners/staff for the following:

- any decline in feed or water consumption of 5% per day for 2 consecutive days

- any decline in egg production of 5% per day for 2 consecutive days, including complete cessation
- abnormal eggshells
- any increase in mortality of more than 0.25% per day for 2 consecutive days
- any decline in hatchability.

Examination of flocks for the following clinical signs:

- general
  - increased mortality
  - decreased feed consumption
  - decreased water consumption
  - apathy (dullness, general depression)
  - huddling
  - reduction in normal vocalisation
  - hiding away
  - hunched-over position
- respiratory disorders
  - tightness of the chest
  - rales
  - swollen sinuses
  - sneezing
  - coughing
  - lying down with an extended neck
- digestive disorders
  - diarrhoea
  - greenish faeces
- nervous disorders
  - tremor of the head
  - abnormal gait
  - lack of coordination
  - lying on one side
  - paralysis
  - inability to stand
  - torticollis
- production disorders
  - decreased growth performance
  - sudden drop in egg production
  - pale eggs
  - decreased eggshell quality
  - increased production of floor eggs.

Field autopsy findings that include any of the following:

- cyanosis of the comb
- haemorrhages and necrosis in the proventriculus, gizzard, and lymphoid tissues in small intestine and caecal tonsils
- petechial haemorrhage on other organs or in the trachea
- catarrhal or congestive tracheitis
- laryngitis
- thickened, cloudy air sacs.

Decisions should be made at the local control centre about which laboratories will be responsible for sample testing, and who will manage and evaluate the results in the following situations:

- before a diagnosis is confirmed
- after a diagnosis is confirmed (the chief veterinary officer will decide whether diagnosis is to be on the basis of clinical signs or laboratory investigation)
- after repopulation of infected premises (IPs) and dangerous contact premises (DCPs) (see Section 4.3.13).

Procedures during the outbreak

Restricted area

Surveillance will begin once the CA has been declared. Arrangements should be made for approved laboratories and private veterinarians to autopsy samples of all species of bird that are found dead, or to collect pooled swabs of trachea and cloaca separately, where examination of the birds is impractical. Flock health can be monitored by:

- twice-weekly (or more frequently if needed) telephone/fax/email reporting by commercial producers, and dead bird pick-up and field visit, if needed
- twice-weekly (or more frequently if needed) telephone surveillance of suspect premises (SPs), and dead bird pick-up and field visit, if needed
- random visits to properties to discuss bird health, production performance and biosecurity measures
- swabbing dead birds (trachea and cloaca) for PCR initially, then virus isolation weekly for SPs and fortnightly for other premises
- serological sampling of flocks to provide a 95% level of confidence that virulent ND virus is not present at the 5% level – titres of >210, or samples in which >25% of the sample have a titre of >25, should be viewed with suspicion (noting that serology cannot distinguish between avirulent and virulent forms of the virus)
- quarantining of suspicious flocks, virus isolation and resampling after 7 days.

Where vaccination is not being practised, surveillance should largely be done by agent detection.

Control area

Surveillance in the CA will begin immediately after the RA has been declared and will involve:

- weekly telephone surveillance of susceptible flocks, including other species, with particular focus on commercial poultry
- swabbing dead birds (trachea and cloaca) for virus isolation at a level sufficient to determine infection with virulent virus in the highest-priority commercial flocks, particularly those to be moved to slaughter

- serological sampling of suspicious flocks and of a representative sample of commercial poultry flocks to provide a 95% level of confidence that virulent ND virus is not present at the 5% level – titres of >210, or samples in which >25% of the sample have a titre of >25, should be viewed with suspicion (noting that serology cannot distinguish between avirulent and virulent forms of the virus)
- weekly reporting on flock health by producers, and random visits to discuss flock performance and biosecurity measures
- follow-up on any unusual disease conditions
- quarantining of suspicious flocks, virus isolation and resampling after 7 days.

Where vaccination is not being practised, surveillance should largely be done by agent detection.

Wider geographical surveys

Wider geographical surveys may be required within the disease-free area if birds or other items were transported from the RA or CA before the disease was recognised. Such surveys should start as soon as there is confidence that the outbreak has been controlled. Surveys should aim at a 95% confidence level of detecting a 5% infection rate in at least 1% of the commercial flocks.

7.2 Proof of freedom

Area proof of freedom will be decided on the body of evidence to hand that no virulent ND virus infection remains in the RA, including on infected premises (IPs); this can only come from the surveillance carried out during and after the period of infection. The evidence needs to be strong enough to be accepted by trading partners.

Proof of freedom from ND on depopulated premises can best be achieved by clinical observations and dead bird sampling of repopulated sheds or sentinel birds, and investigation of possible disease outbreaks, rather than by widespread serological testing.

Serology can be performed in accordance with the National Newcastle Disease Management Plan, where swabs are taken in addition to serology and are tested if birds are seropositive. Serology alone will not provide adequate information about the disease status of the birds. This should be performed on former IPs, DCPs and SPs at 30 days after restocking and at 3 months to establish a 95% confidence of detecting a 5% infection rate. This is to be supported by clinical examinations twice-weekly for 30 days, then fortnightly for 3 months, and virus isolation on dead birds. Seropositive flocks will require further investigation and virus isolation.

Some ancillary surveillance will need to be undertaken in the former RA and CA to demonstrate freedom from ND virus. This surveillance should concentrate on the commercial poultry industry.

Further testing may be considered in other areas if the epidemiological information suggests that it is warranted.

A1 Appendix 1

NEWCASTLE DISEASE FACT SHEET

Disease and cause

Newcastle disease (ND) is a highly contagious viral disease, caused by Newcastle disease viruses, which are members of the avian orthoavulavirus type 1 (AOAV-1) species. In domestic poultry, it is a rapidly fatal disease. In other avian species, disease effects vary from inapparent to fatal.

Species affected

ND virus is infective for almost all avian species, both domestic and wild. Chickens, turkeys, ducks and geese are all susceptible to infection with ND virus; however, chickens are considered to be the most susceptible of domestic poultry species. Pigeons, canaries and wild waterbirds are all known to be susceptible to infection.

Humans are susceptible to infection with ND virus, although infection is uncommon.

Distribution

Strains of ND virus are present in most countries, and avirulent strains are endemic in Australia.

Potential pathways for introduction into Australia

The most likely pathway of introduction of virulent exotic ND into Australia is the smuggling of birds, particularly pigeons and parrots.

Key signs

The clinical signs of ND virus infection are variable and depend on the virus virulence, the affected species, the age and immune status of the infected bird, and many external factors.

Key signs in chickens include changes in shell colour, head nodding, ataxia, loss of balance, respiratory disease, swelling and cyanosis of the comb and wattles, and increased mortality. Turkeys are usually less severely affected, and ducks and geese will show mild, or no, clinical signs.

Birds other than poultry, such as pigeons and wild waterbirds, often have very mild, or no, clinical signs.

Spread

Spread of virulent ND virus between flocks has been attributed to movement of infected birds, poultry products and byproducts; and contaminated clothing, equipment, feed and litter. Windborne spread of

contaminated chicken debris and litter from infected flocks is also known to transmit disease between flocks.

Persistence of the virus

ND virus is stable in the environment. It:

- remains infectious in slaughtered chickens for up to 4 months at 4 °C; infectious virus may survive in eggs laid by infected hens for months at room temperature and for more than 1 year at 4 °C
- can survive on feathers for 255 days and in litter for 42–53 days.
- may remain infectious for long periods on contaminated premises.

Impacts for Australia

One of the largest impacts of an ND outbreak involving the poultry industry would be the social and economic effects. High bird mortalities from infected birds and the policy of stamping out will lead to loss of production and income for an extended period. Disruption of the flow of product and decreased production may cause job losses on farms, and in service and associated industries.

A2 Appendix 2

MOVEMENT PERMIT CONDITIONS

Condition	Requirements
1	Chicks come from source flock in CA.
2	Mortalities and egg production are recorded daily by company personnel. Abnormalities are reported to local control centre. Dead/sick birds are tested by PCR if indicated by increased mortality or reduced egg production.
3	Company declares that records of candling and hatchability meet breed, company and hatchery standards.
4	Transport truck, and transport and hatchery personnel have only operated in CA or OA.
5	Biosecurity plan (especially transport; and movements of personnel, egg fillers and equipment) has been audited by authorised government officer since onset of outbreak.
6	Travel is by approved route only, with no stopping en route.
7	Chicks come from source flock in OA.
8	Vehicles and equipment, including empty egg crates, cartons and/or fillers, are decontaminated (ie cleaned and disinfected) before and after unloading and inspected/certified as such. Decontamination occurs before entry to a new premises or processing facility within the destination declared area or before leaving the destination declared area.
11	Absence of clinical signs of ND in the flock on the premises before and on day of travel.
12	Negative surveillance (by PCR) within 48 hours of slaughter.
13	Mortality records or a quality assurance program.
15	Catching crew and vehicle drivers have dedicated clothing on farm, including boots, and are decontaminated off farm (including showering); catching machine is not to be used.

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18	Birds originating in RA are processed last and identified. Processing facility is decontaminated following processing.
19	Movement for slaughter into the RA only if no other suitable processor (see Section 6.4.7 for movement restrictions on vehicles).
20	Movement for slaughter into the CA only if no other suitable processor (see Section 6.4.7 for movement restrictions on vehicles).
21	Transport is in a covered, leak-proof container and/or vehicle.
22	To transport sealed, closed containers, outside of bin is cleaned and disinfected before removal from premises.
23	Authorised method of disposal (eg composting).
24	Vehicle and equipment are decontaminated after pick-up and delivery, and between declared areas.
25	Authorised dead bird pick-up organisation.
26	Dead birds are not fed to, or brought into contact with, other birds or other susceptible species.
27	Multiple pick-up is permitted only if collection points are at farm perimeter within each designated declared area.
28	Vehicles and equipment are decontaminated appropriately on exit from disposal facility.
29	Movement records are kept of where the product is sold.
30	Vehicles and equipment are disinfected between premises.
31	Eggs are decontaminated on-farm (eg sprayed, fumigated, washed, disinfected). If there is no ability to decontaminate eggs on-farm, floor eggs, cracked eggs or eggs that have visual faecal contamination must not be used, and must be fumigated or washed before setting at the hatchery.
34	Dirty and cracked eggs are removed for safe disposal.
35	Pulp produced on-farm is treated by validated heat treatment (eg pasteurisation).
36	Reuse of cardboard egg fillers is prohibited.
37	Plastic egg fillers are washed and disinfected adequately.
39	Risk analysis is completed for individual properties before egg sales are permitted from individual premises.
40	Egg surfaces are washed or disinfected at source (eg farm, grading facility).
41	If eggs are washed on the farm, they can only be packed onto new cardboard fillers, or new or decontaminated plastic fillers.

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43	No return of egg fillers and packaging from RA to CA or OA.
44	Plastic fillers must only be returned to originating farm.
45	No return of cardboard egg fillers and packaging within RA.
46	Authorised processors.
47	Approved method of processing.
48	Byproducts are not fed to, or brought into contact with, other birds or other susceptible species.
49	To transport sealed, closed containers, outside of bin is cleaned and disinfected before removal from premises and before return to processing plant, CA or OA.
50	Rendered product is separated from raw materials to avoid recontamination or cross-contamination.
51	Waste product is not fed to, or brought into contact with, other birds.
52	To transport sealed, closed containers, outside of bin is cleaned and disinfected before removal from premises and before return to processing plant.
53	Cannot be spread on land without prior processing or treatment. Manure and litter must be moved to an approved premises.
55	Manure moved off an IP or DCP where control measures are in progress is subject to movement controls and quarantine.
56	Negative surveillance (by PCR) on birds within 48 hours of proposed movement.
58	If collected on plastic fillers, an adequate decontamination practice is used before return to the originating farm.
60	Driver ideally should not exit the cabin of the truck.
61	Driver should not have contact with poultry.
62	Driver and cab are decontaminated if driver exits the truck on declared premises (both cab and driver are decontaminated before driver re-enters the cab).
64	Single farm delivery per load (no part loads).

CA = control area; DCP = dangerous contact premises; IP = infected premises; ND = Newcastle disease; OA = outside area, PCR = polymerase chain reaction; RA = restricted area

Glossary

Standard AUSVETPLAN terms

Animal byproducts	Products of animal origin that are not for consumption but are destined for industrial use (eg hides and skins, fur, wool, hair, feathers, hoofs, bones, fertiliser).
Animal Health Committee	A committee whose members are the chief veterinary officers of the Commonwealth, states and territories, along with representatives from the CSIRO Australian Centre for Disease Preparedness (CSIRO-ACDP) and the Australian Government Department of Agriculture, Water and the Environment. There are also observers from Animal Health Australia, Wildlife Health Australia, and the New Zealand Ministry for Primary Industries. The committee provides advice to the National Biosecurity Committee on animal health matters, focusing on technical issues and regulatory policy. *See also* National Biosecurity Committee
Animal products	Meat, meat products and other products of animal origin (eg eggs, milk) for human consumption or for use in animal feedstuff.
Approved disposal site	A premises that has zero susceptible livestock and has been approved as a disposal site for animal carcasses, or potentially contaminated animal products, wastes or things.
Approved processing facility	An abattoir, knackery, milk processing plant or other such facility that maintains increased biosecurity standards. Such a facility could have animals or animal products introduced from lower-risk premises under a permit for processing to an approved standard.

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At-risk premises	A premises in a restricted area that contains a live susceptible animal(s) but is not considered at the time of classification to be an infected premises, dangerous contact premises, dangerous contact processing facility, suspect premises or trace premises.
Australian Chief Veterinary Officer	The nominated senior veterinarian in the Australian Government Department of Agriculture, Water and the Environment who manages international animal health commitments and the Australian Government's response to an animal disease outbreak. *See also* Chief veterinary officer
AUSVETPLAN	Australian Veterinary Emergency Plan. Nationally agreed resources that guide decision making in the response to emergency animal diseases (EADs). It outlines Australia's preferred approach to responding to EADs of national significance, and supports efficient, effective and coherent responses to these diseases.
Carcase	The body of an animal slaughtered for food.
Carcass	The body of an animal that died in the field.
Chief veterinary officer (CVO)	The senior veterinarian of the animal health authority in each jurisdiction (national, state or territory) who has responsibility for animal disease control in that jurisdiction. *See also* Australian Chief Veterinary Officer
Compartmentalisation	The process of defining, implementing and maintaining one or more disease-free establishments under a common biosecurity management system in accordance with OIE guidelines, based on applied biosecurity measures and surveillance, to facilitate disease control and/or trade.
Compensation	The sum of money paid by government to an owner for livestock or property that are destroyed for the purpose of eradication or prevention of the spread of an emergency animal disease, and livestock that have died of the emergency animal disease. *See also* Cost-sharing arrangements, Emergency Animal Disease Response Agreement
Consultative Committee on Emergency Animal Diseases (CCEAD)	The key technical coordinating body for animal health emergencies. Members are state and territory chief veterinary officers, representatives of CSIRO-ACDP and the relevant industries, and the Australian Chief Veterinary Officer as chair.

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Control area (CA)	A legally declared area where the disease controls, including surveillance and movement controls, applied are of lesser intensity than those in a restricted area (the limits of a control area and the conditions applying to it can be varied during an incident according to need).
Cost-sharing arrangements	Arrangements agreed between governments (national and state/territory) and livestock industries for sharing the costs of emergency animal disease responses. *See also* Compensation, Emergency Animal Disease Response Agreement
Dangerous contact animal	A susceptible animal that has been designated as being exposed to other infected animals or potentially infectious products following tracing and epidemiological investigation.
Dangerous contact premises (DCP)	A premises, apart from an abattoir, knackery or milk processing plant (or other such facility) that, after investigation and based on a risk assessment, is considered to contain a susceptible animal(s) not showing clinical signs, but considered highly likely to contain an infected animal(s) and/or contaminated animal products, wastes or things that present an unacceptable risk to the response if the risk is not addressed, and that therefore requires action to address the risk.
Dangerous contact processing facility (DCPF)	An abattoir, knackery, milk processing plant or other such facility that, based on a risk assessment, appears highly likely to have received infected animals, or contaminated animal products, wastes or things, and that requires action to address the risk.
Declared area	A defined tract of land that is subjected to disease control restrictions under emergency animal disease legislation. There are two types of declared areas: restricted area and control area.
Decontamination	Includes all stages of cleaning and disinfection.
Depopulation	The removal of a host population from a particular area to control or prevent the spread of disease.
Destroy (animals)	To kill animals humanely.
Disease agent	A general term for a transmissible organism or other factor that causes an infectious disease.
Disease Watch Hotline	24-hour freecall service for reporting suspected incidences of exotic diseases – 1800 675 888.

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Disinfectant	A chemical used to destroy disease agents outside a living animal.
Disinfection	The application, after thorough cleansing, of procedures intended to destroy the infectious or parasitic agents of animal diseases, including zoonoses; applies to premises, vehicles and different objects that may have been directly or indirectly contaminated.
Disinsectisation	The destruction of insect pests, usually with a chemical agent.
Disposal	Sanitary removal of animal carcasses, animal products, materials and wastes by burial, burning or some other process so as to prevent the spread of disease.
Emergency animal disease	A disease that is (a) exotic to Australia or (b) a variant of an endemic disease or (c) a serious infectious disease of unknown or uncertain cause or (d) a severe outbreak of a known endemic disease, and that is considered to be of national significance with serious social or trade implications. *See also* Endemic animal disease, Exotic animal disease
Emergency Animal Disease Response Agreement	Agreement between the Australian and state/territory governments and livestock industries on the management of emergency animal disease responses. Provisions include participatory decision making, risk management, cost sharing, the use of appropriately trained personnel and existing standards such as AUSVETPLAN. *See also* Compensation, Cost-sharing arrangements
Endemic animal disease	A disease affecting animals (which may include humans) that is known to occur in Australia. *See also* Emergency animal disease, Exotic animal disease
Enterprise	*See* Risk enterprise
Enzyme-linked immunosorbent assay (ELISA)	A serological test designed to detect and measure the presence of antibody or antigen in a sample. The test uses an enzyme reaction with a substrate to produce a colour change when antigen–antibody binding occurs.
Epidemiological investigation	An investigation to identify and qualify the risk factors associated with the disease. *See also* Veterinary investigation

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Epidemiology	The study of disease in populations and of factors that determine its occurrence.
Exotic animal disease	A disease affecting animals (which may include humans) that does not normally occur in Australia. *See also* Emergency animal disease, Endemic animal disease
Exotic fauna/feral animals	See Wild animals
Fomites	Inanimate objects (eg boots, clothing, equipment, instruments, vehicles, crates, packaging) that can carry an infectious disease agent and may spread the disease through mechanical transmission.
General permit	A legal document that describes the requirements for movement of an animal (or group of animals), commodity or thing, for which permission may be granted without the need for direct interaction between the person moving the animal(s), commodity or thing and a government veterinarian or inspector. The permit may be completed via a webpage or in an approved place (such as a government office or commercial premises). A printed version of the permit must accompany the movement. The permit may impose preconditions and/or restrictions on movements. *See also* Special permit
In-contact animals	Animals that have had close contact with infected animals, such as noninfected animals in the same group as infected animals.
Incubation period	The period that elapses between the introduction of a pathogen into an animal and the first clinical signs of the disease.
Index case	The first case of the disease to be diagnosed in a disease outbreak. *See also* Index property
Index property	The property on which the index case is found. *See also* Index case
Infected premises (IP)	A defined area (which may be all or part of a property) on which animals meeting the case definition are or were present, or the causative agent of the emergency animal disease is present, or there is a reasonable suspicion that either is present, and that the relevant chief veterinary officer or their delegate has declared to be an infected premises.

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Local control centre	An emergency operations centre responsible for the command and control of field operations in a defined area.
Monitoring	Routine collection of data for assessing the health status of a population or the level of contamination of a site for remediation purposes. *See also* Surveillance
Movement control	Restrictions placed on the movement of animals, people and other things to prevent the spread of disease.
National Biosecurity Committee	A committee that was formally established under the Intergovernmental Agreement on Biosecurity (IGAB). The IGAB was signed on 13 January 2012, and signatories include all states and territories except Tasmania. The committee provides advice to the Agriculture Senior Officials Committee and the Agriculture Ministers' Forum on national biosecurity issues, and on the IGAB.
National Management Group (NMG)	A group established to approve (or not approve) the invoking of cost sharing under the Emergency Animal Disease Response Agreement. NMG members are the Secretary of the Australian Government Department of Agriculture, Water and the Environment as chair, the chief executive officers of the state and territory government parties, and the president (or analogous officer) of each of the relevant industry parties.
Native wildlife	*See* Wild animals
OIE Terrestrial Code	OIE *Terrestrial Animal Health Code*. Describes standards for safe international trade in animals and animal products. Revised annually and published on the internet at: www.oie.int/en/what-we-do/standards/codes-and-manuals.
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/en/what-we-do/standards/codes-and-manuals.
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.

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Owner	Person responsible for a premises (includes an agent of the owner, such as a manager or other controlling officer).
Polymerase chain reaction (PCR)	A method of amplifying and analysing DNA sequences that can be used to detect the presence of viral DNA.
Premises	A tract of land including its buildings, or a separate farm or facility that is maintained by a single set of services and personnel.
Premises of relevance (POR)	A premises in a control area that contains a live susceptible animal(s) but is not considered at the time of classification to be an infected premises, suspect premises, trace premises, dangerous contact premises or dangerous contact processing facility.
Prevalence	The proportion (or percentage) of animals in a particular population affected by a particular disease (or infection or positive antibody titre) at a given point in time.
Proof of freedom	Reaching a point following an outbreak and post-outbreak surveillance when freedom from the disease can be claimed with a reasonable level of statistical confidence.
Qualifiers	
– assessed negative	Assessed negative (AN) is a qualifier that may be applied to ARPs, PORs, SPs, TPs, DCPs or DCPFs. The qualifier may be applied following surveillance, epidemiological investigation, and/or laboratory assessment/diagnostic testing and indicates that the premises is assessed as negative at the time of classification.
– sentinels on site	Sentinels on site (SN) is a qualifier that may be applied to IPs and DCPs to indicate that sentinel animals are present on the premises as part of response activities (ie before it can be assessed as an RP).
– vaccinated	The vaccinated (VN) qualifier can be applied in a number of different ways. At its most basic level, it can be used to identify premises that contain susceptible animals that have been vaccinated against the EAD in question. However, depending on the legislation, objectives and processes within a jurisdiction, the VN qualifier may be used to track a range of criteria and parameters.

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Quarantine	Legally enforceable requirement that prevents or minimises spread of pests and disease agents by controlling the movement of animals, persons or things.
Resolved premises (RP)	An infected premises, dangerous contact premises or dangerous contact processing facility that has completed the required control measures, and is subject to the procedures and restrictions appropriate to the area in which it is located.
Restricted area (RA)	A relatively small legally declared area around infected premises and dangerous contact premises that is subject to disease controls, including intense surveillance and movement controls.
Risk enterprise	A defined livestock or related enterprise that is potentially a major source of infection for many other premises. Includes intensive piggeries, feedlots, abattoirs, knackeries, saleyards, calf scales, milk factories, tanneries, skin sheds, game meat establishments, cold stores, artificial insemination centres, veterinary laboratories and hospitals, road and rail freight depots, showgrounds, field days, weighbridges and garbage depots.
Sensitivity	The proportion of truly positive units that are correctly identified as positive by a test. *See also* Specificity
Sentinel animal	Animal of known health status that is monitored to detect the presence of a specific disease agent.
Seroconversion	The appearance in the blood serum of antibodies (as determined by a serology test) following vaccination or natural exposure to a disease agent.
Serosurveillance	Surveillance of an animal population by testing serum samples for the presence of antibodies to disease agents.
Serotype	A subgroup of microorganisms identified by the antigens carried (as determined by a serology test).
Serum neutralisation test	A serological test to detect and measure the presence of antibody in a sample. Antibody in serum is serially diluted to detect the highest dilution that neutralises a standard amount of antigen. The neutralising antibody titre is given as the reciprocal of this dilution.

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Slaughter	The humane killing of an animal for meat for human consumption.
Special permit	A legal document that describes the requirements for movement of an animal (or group of animals), commodity or thing, for which the person moving the animal(s), commodity or thing must obtain prior written permission from the relevant government veterinarian or inspector. A printed version of the permit must accompany the movement. The permit may impose preconditions and/or restrictions on movements. *See also* General permit
Specificity	The proportion of truly negative units that are correctly identified as negative by a test. *See also* Sensitivity
Stamping out	The strategy of eliminating infection from premises through the destruction of animals in accordance with the particular AUSVETPLAN manual, and in a manner that permits appropriate disposal of carcasses and decontamination of the site.
State coordination centre	The emergency operations centre that directs the disease control operations to be undertaken in a state or territory.
Surveillance	A systematic program of investigation designed to establish the presence, extent or absence of a disease, or of infection or contamination with the causative organism. It includes the examination of animals for clinical signs, antibodies or the causative organism.
Susceptible animals	Animals that can be infected with a particular disease.
Suspect animal	An animal that may have been exposed to an emergency disease such that its quarantine and intensive surveillance, but not pre-emptive slaughter, is warranted. or An animal not known to have been exposed to a disease agent but showing clinical signs requiring differential diagnosis.
Suspect premises (SP)	Temporary classification of a premises that contains a susceptible animal(s) not known to have been exposed to the disease agent but showing clinical signs similar to the case definition, and that therefore requires investigation(s).

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

i. milk, milk products or milk byproducts either of Australian provenance or legally imported for stockfeed use into Australia

ii. material containing flesh, bones, blood, offal or mammal carcases that is treated by an approved process[1]

iii. a carcass or part of a domestic pig, born and raised on the property on which the pig or pigs that are administered the part are held, that is administered for therapeutic purposes in accordance with the written instructions of a veterinary practitioner.

iv. material used under an individual and defined-period permit issued by a jurisdiction for the purposes of research or baiting.

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

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

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

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Swill feeding	Also known as 'feeding prohibited pig feed', it includes: • feeding, or allowing or directing another person to feed, prohibited pig feed to a pig • allowing a pig to have access to prohibited pig feed • the collection and storage or possession of prohibited pig feed on a premises where one or more pigs are kept • supplying to another person prohibited pig feed that the supplier knows is for feeding to any pig. This definition was endorsed by the Agriculture Ministers' Council through AGMIN OOS 04/2014.
Trace premises (TP)	Temporary classification of a premises that contains susceptible animal(s) that tracing indicates may have been exposed to the disease agent, or contains contaminated animal products, wastes or things, and that requires investigation(s).
Tracing	The process of locating animals, people or other items that may be implicated in the spread of disease, so that appropriate action can be taken.
Unknown status premises (UP)	A premises within a declared area where the current presence of susceptible animals and/or risk products, wastes or things is unknown.
Vaccination	Inoculation of individuals with a vaccine to provide active immunity.
Vaccine	A substance used to stimulate immunity against one or several disease-causing agents to provide protection or to reduce the effects of the disease. A vaccine is prepared from the causative agent of a disease, its products or a synthetic substitute, which is treated to act as an antigen without inducing the disease.
– adjuvanted	A vaccine in which one or several disease-causing agents are combined with an adjuvant (a substance that increases the immune response).
– attenuated	A vaccine prepared from infective or 'live' microbes that are less pathogenic but retain their ability to induce protective immunity.
– gene deleted	An attenuated or inactivated vaccine in which genes for non-essential surface glycoproteins have been removed by genetic engineering. This provides a useful immunological marker for the vaccine virus compared with the wild virus.

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– inactivated	A vaccine prepared from a virus that has been inactivated ('killed') by chemical or physical treatment.
– recombinant	A vaccine produced from virus that has been genetically engineered to contain only selected genes, including those causing the immunogenic effect.
Vector	A living organism (frequently an arthropod) that transmits an infectious agent from one host to another. A *biological* vector is one in which the infectious agent must develop or multiply before becoming infective to a recipient host. A *mechanical* vector is one that transmits an infectious agent from one host to another but is not essential to the lifecycle of the agent.
Veterinary investigation	An investigation of the diagnosis, pathology and epidemiology of the disease. *See also* Epidemiological investigation
Viraemia	The presence of viruses in the blood.
Wild animals	
– native wildlife	Animals that are indigenous to Australia and may be susceptible to emergency animal diseases (eg bats, dingoes, marsupials).
– feral animals	Animals of domestic species that are not confined or under control (eg cats, horses, pigs).
– exotic fauna	Nondomestic animal species that are not indigenous to Australia (eg foxes).
Wool	Sheep wool.
Zero susceptible species premises (ZP)	A premises that does not contain any susceptible animals or risk products, wastes or things.
Zoning	The process of defining, implementing and maintaining a disease-free or infected area in accordance with OIE guidelines, based on geopolitical and/or physical boundaries and surveillance, to facilitate disease control and/or trade.
Zoonosis	A disease of animals that can be transmitted to humans.

Abbreviations

Disease-specific abbreviations

AOAV	avian orthoavulavirus
HI	haemagglutination inhibition
ND	Newcastle disease
PPMV	pigeon paramyxovirus

Standard AUSVETPLAN abbreviations

ACDP	Australian Centre for Disease Preparedness
AN	assessed negative
ARP	at-risk premises
AUSVETPLAN	Australian Veterinary Emergency Plan
CA	control area
CCEAD	Consultative Committee on Emergency Animal Diseases
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CVO	chief veterinary officer
DCP	dangerous contact premises
DCPF	dangerous contact processing facility
EAD	emergency animal disease
EADRA	Emergency Animal Disease Response Agreement

Cont'd

EADRP	Emergency Animal Disease Response Plan
EDTA	ethylenediaminetetraacetic acid (anticoagulant for whole blood)
ELISA	enzyme-linked immunosorbent assay
GP	general permit
IETS	International Embryo Technology Society
IP	infected premises
LCC	local control centre
NMG	National Management Group
OA	outside area
OIE	World Organisation for Animal Health
PCR	polymerase chain reaction
POR	premises of relevance
RA	restricted area
RP	resolved premises
SCC	state coordination centre
SP	suspect premises
SpP	special permit
TP	trace premises
UP	unknown status premises
ZP	zero susceptible species premises

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