AUSTRALIAN VETERINARY EMERGENCY PLAN

AUSVETPLAN

1996

Disease Strategy

Virulent avian influenza

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

Agriculture and Resource Management Council of Australia and New Zealand

This Disease Strategy forms part of:

AUSVETPLAN Edition 2.0, 1996

[AUSVETPLAN Edition 1.0, was published in 1991]

This strategy will be reviewed regularly. Suggestions and recommendations for amendments should be forwarded to the AUSVETPLAN Coordinator (see Preface).

Record of amendments to this manual:

[Insert record of amendments as necessary]

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PREFACE

This **Disease Strategy** for the control and eradication of **virulent avian influenza** is an integral part of the **Australian Veterinary Emergency Plan**, or AUSVETPLAN (Edition 2.0). AUSVETPLAN structures and functions are described in the **Summary Document.**

This strategy sets out the disease control principles approved in February 1991 by the then Australian Agricultural Council out-of-session at meeting 135, for use in an animal health emergency caused by the introduction of virulent avian influenza disease in Australia. The strategy has been updated and approved by the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) out-of-session in January 1996.

Avian influenza is designated as a List A disease by the Office International des Epizooties (OIE). List A diseases are, 'Communicable diseases that have the potential for serious and rapid spread, irrespective of national borders; which are of serious socioeconomic or public health importance and which are of major importance in the international trade of animals and animal products'. The principles contained in this document for the diagnosis and management of an outbreak of avian influenza conform with the OIE International Animal Health Code 1992 (OIE Code; see Appendix 3).

Virulent avian influenza is included in the list of diseases for which arrangements exist under the Commonwealth/States cost-sharing agreement for the eradication of certain exotic animal diseases. Information on the cost-sharing arrangements can be found in the AUSVETPLAN **Summary Document** and **Valuation and Compensation Manual.**

Detailed instructions for the field implementation of the strategies are contained in the **Operational Procedures Manuals** and **Management Manuals**. Cross-references to strategies, manuals, and other AUSVETPLAN documents are expressed in the form:

> Document Name, Section no.
> For example, **Decontamination Manual, Section 3**.

In addition, *Exotic Diseases of Animals: A Field Guide for Australian Veterinarians* by W.A. Geering, A.J. Forman and M.J. Nunn, Australian Government Publishing Service, Canberra, 1995 (**Exotic Diseases Field Guide**) is a source for some of the information about the aetiology, diagnosis and epidemiology of the disease and should be read in conjunction with this strategy.

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The writing group was responsible for drafting this strategy. However, the text may have been amended at various stages of the consultation/approval process and the policies expressed in this version do not necessarily represent the views of all members of the writing group. Contributions may also have been made by other people not listed above and the assistance of all involved is gratefully acknowledged.

CONTENTS

1 NATURE OF THE DISEASE

Virulent avian influenza is a highly contagious, generalised viral disease that may cause high mortality in gallinaceous species of birds in association with respiratory, gastrointestinal and/or nervous signs. In other avian species, avian influenza (AI) virus infection may range clinically from an inapparent to a highly lethal disease. Wild aquatic birds, such as waterfowl and seabirds are recognised as important reservoirs for avian influenza virus.

1.1 Aetiology

AI viruses are members of the family Orthomyxoviridae. The influenza viruses that constitute this family are categorised into types A, B or C on the basis of the antigenic character of the internal nucleoprotein antigen. Only influenza A viruses have been isolated from avian species.

Influenza A viruses are further divided into subtypes determined by haemagglutinin (H) and neuraminidase (N) antigens. At present, there are 14 H subtypes and 9 N subtypes. Each virus has one of each subtype in any combination. Only H5 and H7 have been isolated from virulent disease in poultry. These two strains are considered to be high risk strains for antigenic drift toward highly pathogenic avian influenza. The cleavability of viral haemagglutinins by proteolytic enzymes is associated with virulence of virus strains for chickens. The OIE definition of pathogenicity is explained in Appendix 3.

Avian influenza viruses of most H and N subtypes have been isolated from a wide range of wild waterbirds including migratory species in well-separated locations throughout Australia. An AI virus, virulent for domestic poultry, could emerge from the pool of AI viruses in wild birds at any time.

1.2 Susceptible species

AI virus is infective for almost all commercial, domestic and wild avian species. Infections in monkeys, pigs, ferrets, horses, cattle, seals and whales have been reported. The significance of non-avian species spreading the disease is not known.

Chickens and turkeys

- Highly susceptible to infection and clinical disease.

Ducks and geese

- Susceptible to all AI virus strains but only very virulent strains produce clinical disease. AI virus is commonly isolated from these species in endemic areas. Their potential as reservoir hosts are considered to make waterfowl a major source of virus for poultry.

Guinea fowl, quail, pheasant and partridge

- Susceptible to infection and clinical disease.

Wild birds

- AI viruses are readily recovered from free-flying birds throughout the world. No significant disease problems due to avian influenza are known to occur in these birds. However, research workers suggest that the huge pool of viruses in wild birds,

especially waterfowl where the virus replicates in the intestine, provides the opportunity for virulent strains to arise through genetic re-assortment.

- Field surveys have suggested that many species of waterfowl, particularly ducks, geese and swans are the natural hosts of AI viruses. AI viruses have also been recovered from gulls, terns and shearwaters. Intensive surveillance of wild birds during the 1983–4 AI outbreak in Pennsylvania confirmed that aquatic birds harboured many influenza viruses.

Cage birds, including psittacines and canaries

- The subtypes isolated worldwide from the respiratory tract of captured wild and exotic birds have not been isolated from cage birds.

Emus and ostriches

- Avian influenza virus subtypes H5N2 and H7N1 have been isolated from emus and rheas, demonstrating their susceptibility to infection, in the United States. However, AIV was not confirmed as the cause of disease or death (Panigrahy et al 1995).
- Avian influenza has been associated with a syndrome characterised by respiratory signs, enteritis, weakness and death of ostriches in South Africa. An outbreak involving over 20% mortality was reported to the Office International des Epizooties (OIE) in April 1994.

1.3 World distribution and occurrence in Australia

Avian influenza virus occurs, in one or a number of its many serotypes, in all continents where research has been carried out. It appears to be endemic in waterfowl, where it does not often cause disease. Migratory waterfowl are considered to be one of the means by which the disease travels across and between continents (Easterday and Beard 1984). Reports on the prevalence of AIV infection in waterfowl range from 0.6% to 26% (Alfonso et al 1995).

The AI virus has been considered the cause of clinical disease in commercial poultry four times in Australia. It occurred in Victoria in 1976, 1985, 1992 and in Queensland in 1994. Each time, there was severe disease in chicken flocks and all had obvious or circumstantial evidence of contact with waterfowl. The Victorian outbreaks of 1976 and 1985 were both caused by H7N7. The outbreaks in Victoria (1992) and Queensland (1994) were caused by H7N3.

1.4 Diagnostic criteria

[For terms not defined in the text see Glossary]

1.4.1 Clinical signs

The clinical signs of AI infection are variable and influenced greatly by the virulence of the virus strains involved, the species affected, age, concurrent bacterial disease and the environment.

Infection with avirulent strains:

- no clinical signs in infected birds — however birds can seroconvert. Some of these viruses have the potential to become virulent.

Infection with strains of low pathogenicity:

- clinical signs in chickens and turkeys range from inapparent to mild or severe respiratory disease and can be confused with infectious laryngotracheitis;
- mortality ranges from 3% in caged layers to 15% in meat chickens; and
- egg production in layers can drop by up to 45% with recovery to normal in 2–4 weeks.

Infection with highly pathogenic strains:

- clinical signs in chickens and turkeys include severe respiratory signs with excessively watery eyes and sinusitis, cyanosis of the combs, wattle and shanks, oedema of the head, ruffled feathers, diarrhoea and nervous signs;
- the last eggs laid after the onset of illness frequently have no shells.
- in acute cases involving sudden death, clinical signs may not be seen; mortalities occur as early as 24 hours after the first signs of the disease, and frequently within 48 hours, or can be delayed for as long as a week (mortality rates nearing 100% have been reported); and
- some severely affected hens may recover, but rarely come back into lay.

The disease in turkeys is similar to that seen in chickens, but is often complicated by secondary infections such as fowl cholera, turkey coryza and colibacillosis.

1.4.2 Pathology

Gross lesions

Haemorrhagic, necrotic, congestive and transudative changes are characteristic of acute infections with virulent AI viruses.

The oviducts and intestines often have severe haemorrhagic changes. As the disease progresses, the pancreas, liver, spleen, kidney and lungs can display yellowish necrotic foci.

Haemorrhages (petechial and ecchymotic) cover the abdominal fat, serosal surfaces and peritoneum. The peritoneal cavity is frequently filled with yolk from ruptured ova, associated with severe inflammation of the airsacs and peritoneum in birds that survive 7–10 days. Haemorrhages may be present in the proventriculus, particularly at the junction with the gizzard.

Microscopic lesions (histopathology)

The changes described above are not definitive for AI, although vasculitis in the brain and other organs, may be highly suggestive of the disease.

Diagnosis needs to be confirmed by the isolation and characterisation of virus. Bacteriology should be performed to exclude bacterial septicaemias from the differential diagnosis.

Pathogenicity

There is extreme variation in virulence among subtypes of AI, and a variety of subtypes are widespread throughout native and migratory bird populations. Subtypes of low pathogenicity can:

- be associated with severe clinical disease in the presence of other infectious agents, eg, infectious bronchitis, infectious laryngotracheitis and;

- have the potential to become virulent.

Pathogenicity of AI viruses depends on the genetic properties of the virus and the species of the host.

1.4.3 Laboratory tests

Animal specimens should initially be sent to the State or Territory diagnostic laboratory from where they will be forwarded to the Australian Animal Health Laboratory (AAHL), Geelong for exotic disease testing after obtaining the necessary clearance from the chief veterinary officer (CVO) of the State or Territory of the disease outbreak and informing the CVO of Victoria (for transport of the specimens to Geelong).

Specimens required/transport

Samples should be taken both from live, clinically-affected birds and from recently dead birds. Cloacal and tracheal swabs and/or fresh faeces and serum should be taken from live birds. From dead birds, alimentary tissues (proventriculus, intestine, caecal tonsil) and respiratory tissues (trachea, lung) should be collected. For details of sample collection, transport, storage and processing, see Geering et al 1995.

Laboratory diagnosis

Tests currently available at AAHL are shown in Table 1.

Table 1 Diagnostic tests currently available at AAHL for Avian influenza

Test	Specimen required	Test detects	Time taken to obtain result
Immunofluorescence	fresh tissue (pancreas)	viral antigen	4 hours
Immunohistochemistry	formalin fixed tissues	viral antigen	2 days
Virus isolation	tissues	virus	2–10 days
Virus identification by HI, EM/immune EM, neuraminidase test	virus isolate	specific antigens	4 days
Serology on flocks and surrounding flocks: HI subtype specific, ELISA/AGDP group specific	serum	antibody	1 day
Pathogenicity tests: bird challenge	virus isolate	pathogen and pathogenicity of virus	2–8 days
PCR/gene sequencing	virus isolate	virulence markers	5–8 days

Note: Abbreviations are defined under Glossary.
Source: Information provided by AAHL, 1995 [refer to AAHL for most up-to-date information].

Tests for subtype

- Influenza viruses can be typed as either A, B or C, but all avian influenza viruses of poultry have been type A. Avian influenza virus strains are subtyped on the basis of their haemagglutinin (H) and neuraminidase (N) structure. There are 13 different H subtypes and 9 N subtypes, with all combinations possible. Strains pathogenic for poultry have been only H5 and H7.

Tests for pathogenicity

- *Chicken pathogenicity tests* are done by intravenous inoculation of isolated virus into SPF chickens (also see the OIE definition of pathogenicity in Appendix 3).
- *Molecular pathotyping* is done by nucleotide sequencing of a particular segment of the gene encoding the haemagglutinin protein of the virus. There are well recognised differences between the gene sequence of highly pathogenic and less/non-pathogenic strains.

Tests for previous infection

- Evidence of previous AI infection can be obtained by looking for influenza A group specific antibodies (AGDP or ELISA) or subtype-specific (HI) antibodies.

1.4.4 Differential diagnosis

Avian influenza and Newcastle disease (ND) of chickens and turkeys are frequently indistinguishable on clinical and postmortem examination from:

- mycoplasmosis;
- fowl cholera;
- *E coli* cellulitis of the head;
- acute pasteurellosis;
- infectious laryngotracheitis (ILT);
- infectious coryza;
- acute poisoning; or
- misadventure causing high mortality (eg smothering, heat stress, dehydration).

Virulent AI should be suspected whenever sudden bird deaths occur with severe depression, loss of appetite, nervous signs, watery diarrhoea, severe respiratory signs and/or a drastic drop in egg production with production of abnormal eggs. The likelihood of AI is increased by the presence of facial subcutaneous oedema, swollen and cyanotic combs and wattles, and petechial haemorrhages on the internal membrane surfaces.

Young chickens, or those dying from the peracute form of the disease, may not show any lesions.

See also the discussion on pathogenicity in Section 1.4.2, above.

1.5 Resistance and immunity

1.5.1 Innate and passive immunity

Waterfowl and many other species of wild birds are innately resistant to disease but not infection.

1.5.2 Active immunity

Immunity persists for varying lengths of time. The United States Government control programs during the 1983–84 outbreak in Pennsylvania demonstrated that some flocks, which had seroconverted but were not showing clinical signs of AI, were generally seronegative six weeks after they were assumed to have been infected. However, other infected flocks that recovered were seropositive for up to a year later, although virus could not be isolated.

Other work demonstrated that birds infected with non-pathogenic strains were protected against challenge with pathogenic strains having similar surface antigen.

1.5.3 Vaccination

The current state of knowledge precludes the use of non-pathogenic strains as live vaccines because of the likelihood of re-assortment taking place to produce highly pathogenic strains.

Inactivated vaccines utilising H subtype antigens have been used to control the mildly pathogenic viruses in turkeys. These vaccines assist in controlling the problem of mild AI exacerbated by secondary infections such as fowl cholera, turkey coryza and colibacillosis. However, such vaccines would not be appropriate for infections with H5 or H7 subtypes.

Vaccines made from H subtype antigens interfere with serological diagnosis by HI test; however, a vaccine made from N subtype antigen demonstrated protection when challenged with H5 virus. The vaccine prevented mortality but not infection.

If an outbreak of highly pathogenic avian influenza occurs in the United States, US vaccine companies will be allowed to provide H5 and H7 killed vaccines for commercial use under guidelines specified by the government. In the United States, trivalent H4, H5 and H6 vaccines have been used in turkey breeders as a preventive measure. When vaccine is used during an outbreak the risk of spread by vaccinating crews is a concern.

The problems associated with AI vaccination were clarified by Cross (1985). The efficacy and duration of immunity are not known. The short incubation period (1–3 days) may prevent an anamnestic response to vaccination in the face of an outbreak. There are many antigenic types, which make it impossible to predict the subtype for a vaccine. Vaccination does not prevent infection; therefore antigenic drift could occur in the vaccinated bird. The mutant strains that develop could subsequently infect other vaccinated birds that would not be protected against the mutant strain. AI vaccines are therefore not currently considered to be an option**.**

1.6 Epidemiology

1.6.1 Incubation period

Incubation periods are extremely variable, from a few hours to two to three days. The OIE Code gives a maximum incubation period, for regulatory purposes, of 21 days (see Appendix 3).

1.6.2 Persistence of virus

General properties/environment

- AI virus can survive in faeces for at least 35 days at 4°C and virus in dust in poultry houses has been reported for two weeks after depopulation. AI virus can survive within the poultry house environment for up to 5 weeks (Webster et al 1978).
- The virus is stable over a pH range of 5.5-8.
- Virus may remain infective in lake water for up to 4 days at 22°C and over 30 days at 0°C (Webster et al 1978).

- Environmental conditions have a marked effect on virus survival outside the bird. Survival is prolonged by low relative humidity and low temperature in aerosols, whereas low temperature and high moisture levels prolong survival in faeces.
- The presence of lipid in the AI virus envelope is associated with a high level of susceptibility to disinfectants, including detergents (see Section 2.2.8)

AI virus can be isolated from lake water where waterfowl are present (Hinshaw et al 1979). Acidification of potentially contaminated drinking water to pH 2.5 should minimise spread from lakes and dams.

Wild birds

Waterfowl:

- wild aquatic birds, such as waterfowl and seabirds are important reservoirs and can shed AI virus for up to one month, compared with two weeks in domestic species.

Wild birds:

- AI virus has been recovered from autolysed carcases of wild birds, other than waterfowl, after 23 days at 4°C. AI virus has been isolated from captured exotic species but the duration of virus excretion is not known.

Game birds:

- AI virus was recovered from pheasants, partridges and guineafowl for up to 7 days after infection during the outbreak in the United States in 1983–84.

Cage birds including psittacines and canaries:

- subtypes isolated from wild birds have not yet been isolated from cage birds.

Live poultry

Viruses with the potential to be highly pathogenic for chickens and turkeys can be carried and shed in faeces and from the respiratory tract for at least two weeks and up to 30 days by birds that have recovered from the disease, while the highly pathogenic viruses can be carried by other species without signs of clinical disease (Webster et al 1978).

Continuous cloacal shedding can continue for longer than 30 days after infection in the presence of immunosuppressive diseases or other physical stresses.

Mammals

As indicated in Section 1.2, AI viruses can replicate in mammals and have been recovered from experimentally-infected pigs, ferrets and cats for several days after infection.

No evidence exists of infection in humans, although mechanical transfer is possible in hair and on clothing.

Carcases

AI virus survives only several days in carcases at ambient temperatures, compared with up to 23 days at refrigeration temperatures. There is insufficient data on the spread of virus from fresh, frozen and processed meat. Birds processed during the viraemic stage will contaminate other carcases with blood or faecal material containing virus. Packaging and the drips that develop during storage are also important as both can be contaminated with virus from infected carcases. On the basis of the Australian experience, however, there is no evidence that carcases and animal products have contributed to recycling virus back to poultry.

Meat products

Virus can persist in poultry meat products. Agreed (Moses et al 1948, AQIS 1991) minimum core temperatures to kill AI and ND viruses are:

- 70°C for a minimum of 30 minutes
- 75°C for a minimum of 5 minutes
- 80°C for a minimum of 1 minute

Precooked products for the retail market such as roasted and smoked poultry and poultry rolls, secondary products such as poultry stock cubes, soup mixes, canned and dried pet food should satisfy the minimum core temperature requirements. However, flash fried products needing further processing, such as poultry nuggets prepared for the restaurant and fast food markets, do not meet these requirements.

Table eggs and egg products

Although severely affected birds will cease to lay, eggs laid in the early phase of the outbreak could contain AI virus in the albumen and yolk and on the surface. The virus can penetrate cracked or intact shells or, more significantly, contaminate the egg fillers. The survival time on the eggs and fillers is sufficient to allow wide dissemination. Sanitising the eggs and fillers with a sanitiser containing 50–200 ppm of available chlorine, or other registered sanitisers, will eliminate the virus from clean surfaces.

Egg pulp products are another potential source of the virus. Current pasteurisation procedures approved by the National Food Authority are:

- whole egg: 2.5 minutes at 64.5°C
- egg yolk: 3.5 minutes at 60°C
- egg white: 9 minutes at 55.5°C

While 4.5 minutes at 64°C is assumed to kill AI virus strains, 2.5 minutes at 64°C will not eliminate the virus.

Fertile eggs

AI virus has been isolated from eggs laid by infected breeding hens.

Poultry by-products

Rendered meals, produced from frames (boned out skeletons), viscera, blood, feathers, feet, heads, necks, off-cuts, birds dead in trucks and discarded live birds, are added to poultry feed as poultry offal meal and tallow. They may also be added to pet foods.

Poultry offal meal and pet foods are usually cooked at above 100°C for several minutes to more than one hour, which is sufficient to kill AI virus. However, if the procedure is not carried out properly or cooked product is subsequently contaminated by unprocessed product, AI virus could persist in the by-product for several weeks.

Waste products

Waste can be any of the unwanted by-products of processing. All products that go into the production of rendered meals may also be discarded as waste. In addition, there will be wastes from hatcheries, laboratories (cultures and specimens, dead birds), farms, egg marketing establishments (unsaleable eggs, egg shells after pulping, solid egg fillers) as well as chicken manure and litter. AI virus has the potential to persist in these products and could be disseminated by vehicles that transport them.

Fomites

Persistence of the virus in faeces (see above) is of major importance because its sticky nature facilitates spread over a wide geographical area on footwear, clothing, equipment and other fomites.

1.6.3 Modes of transmission

Live birds

Direct or indirect contact with migratory waterfowl is the most likely source of infection in poultry. AI virus from waterfowl can remain viable in faeces and water for up to 32 days. Transmissibility in poultry varies enormously between AI virus or strains. Contact is important while airborne spread is not considered significant. Work in the United States has detected virus in a sample up to 45 metres downwind of infected flocks.

Experimental work in turkeys showed that infection readily passed to susceptible birds on contact, but not to birds housed one metre off the floor. Westbury et al (1981) also showed that A/duck/Victoria/76 (H7N7) was able to spread quickly to contact chickens but A/chicken/Victoria/76 (H7N7) spread slowly. The methods of spread from bird to bird are therefore poorly understood. Field outbreaks are further complicated by having to distinguish between direct transmission and that of secondary spread by people and fomites.

Eggs

Vertical transmission via infected eggs has never been proven although AI virus has been detected on the shell surface and in the yolk and albumen of eggs, suggesting that the potential for spread exists. Normal incubation temperatures of 38.7°C in the early stages of embryo development may be lethal to AI virus, or infected embryos may be killed by the virus early during incubation.

Fomites

Overseas experience has shown that avian influenza can spread very rapidly and can be carried over long distances by transport of contaminated materials such as bird cages, pallets, egg filler flats, manure and feed.

Vectors

There is no evidence to suggest that invertebrate vectors are involved in the interepizootic maintenance of transmission (Easterday and Beard 1984). However, there is a possibility of mechanical transmission by invertebrate or vertebrate vectors.

1.6.4 Factors influencing transmission

Many variables exist and the details of natural transmission are not known. This is not surprising. The transmission of virus within and among flocks depends on several interacting factors such as the amount of virus shed and the duration of shedding, bird species, housing and population density, environmental conditions that promote virus survival, and opportunities for mechanical spread by people, equipment and other vectors.

Factors influencing transmission in Australian flocks are addressed in the section on persistence of the agent (Section 1.6.2).

1.7 Manner and risk of introduction

Evidence strongly suggests that waterfowl are the likely source in many outbreaks (Geering 1990). The virus transfers to the susceptible flock through close contact between live birds but could also be due to using untreated water from dams or creeks that has been contaminated with waterfowl droppings.

2 PRINCIPLES OF CONTROL AND ERADICATION

2.1 Introduction

Infection of commercial poultry flocks with virulent AI virus would be recognised quickly. However, infection with non-pathogenic or low pathogenicity strains may not be readily recognised. Although it would be desirable to eradicate all AI viruses isolated from commercial poultry, it will be necessary to determine the virulence of any isolate to decide on the appropriate strategy as eradication is directed towards virulent avian influenza. AI virus is stable under a range of environmental conditions allowing it to be spread directly from flock to flock and via fomites or drinking water (see Section 1.6.2).

The basis of eradication of virulent avian influenza in Australia will be the rapid imposition of effective quarantine, stamping out by isolation of infected and potentially-infected birds followed as rapidly as possible by slaughter and sanitary disposal of carcases, decontamination and prevention of movement of contaminated materials. It may also involve the control and limited destruction of wild birds and animals that could spread the disease.

Key factors in achieving these objectives will be rapid reporting and diagnosis together with swift imposition of effective movement controls.

2.2 Methods to prevent spread and eliminate pathogens

2.2.1 Quarantine and movement controls

As AI is readily transmitted via fomites, strict control of movement of anything that may have become contaminated with virus and immediate imposition of tightly controlled quarantine on all places suspected of being infected is essential to a successful eradication program. Quarantine should be imposed on all farms on which infection is either known or suspected and should be strictly policed to ensure that no one, including the owners, staff and other visitors, leaves without changing clothes and footwear. Particular attention needs to be paid to workers on poultry farms who keep backyard poultry at home. The involvement of wild birds in the spread of disease could not be proved in the 1983–84 outbreak in Pennsylvania, United States. Ducks were shown to be a reservoir of pathogenic virus but strict on-farm quarantine and hygiene could control the disease. Access of wild birds to commercial poultry sheds and flocks should be borne in mind when choosing the order in which to start depopulation operations.

Effective quarantine of an area will require security to be maintained around the clock to ensure that only authorised personnel, in protective clothing, are allowed to enter. It will be necessary to supervise the movements of residents on to and off the property and to ensure that all pets are confined. It may also be necessary to ban pigeon racing and other avian concentrations in the outbreak area.

Infected premises and dangerous contact premises

Quarantine of an infected premises (IP) prevents spread of the disease from the property by prohibiting movement of birds, products and materials to or from the property. It is important to apply quarantine measures as early as possible to slow the rate of spread in an

area, and until a full appreciation of the epidemiological situation can be generated. It may take several weeks before there can be any confidence that no other properties in the area are incubating the disease and, in this time, the strictest quarantine measures must be maintained. Dangerous contact premises (DCPs) should be slaughtered out before the flocks excrete virulent virus.

Restricted areas and control areas

The declaration of a restricted area (RA), which should include the IPs, DCPs and, if possible, suspect premises (SPs), assists in preventing spread by restricting movement into, within and out of the area. However, movement controls should not hinder the movements of the general public.

For more information see Appendix 1.

Movement controls in a restricted area

Recommendations are listed in Appendix 2.

Zoning

When the first outbreaks of avian influenza occurred in Australia (1976, 1985) the initial response was for States to close their borders until the extent of the disease were known. The later outbreaks (1992, 1994) saw less reaction in this way, as experience from the earlier outbreaks indicated the almost non-existence of spread from the infected properties.

Consideration should be given, however, to the possibility of an outbreak that is not as easily controlled or where the incident may be occurring in an area that crosses a state border. This could more rationally be handled by declaring a zone rather than a state as the operational boundary. Such an arrangement would need to be endorsed by CCEAD (see Section 3.1) and be consistent with the OIE Code (see Appendix 3).

Understandable pressure to impose interstate (and possibly even intrastate) movement controls on poultry products may be expected. It is desirable to minimise such controls because they cause a large part of the economic losses suffered by the uninfected industry during an exotic disease outbreak. Interstate commerce involving poultry products from outside the RA do not pose any real danger of disease transmission.

2.2.2 Tracing

The information obtained from tracing will help to decide the extent of the RA and CA and identify any additional DCPs and SPs. Information required should be requested on Animal Emergency Information System (ANEMIS) forms.

- The critical date is determined as the earliest time the virus could have entered the place and should be consistent with the maximum incubation period, designated by OIE, of 21 days.
- Movements to and from IPs and DCPs for at least 21 days before the first observation of unusual morbidity or mortality should be traced as a foremost priority.
- Movements should be traced of birds, eggs, poultry products, feed, litter, waste, equipment, and people.
- People involved with feed delivery, plus vaccinating crews, catching crews, tradespeople, company service people and veterinarians should be interviewed and lists compiled of all possible contacts for three days after visiting any premises under suspicion.

- The original source of introduction of the virus should be traced (see section 1.7) as it could remain a threat.

2.2.3 Surveillance

Active surveillance should be initiated as soon as virulent AI is suspected. In the initial stages, at least, a sample of all species of bird that die in the RA should be checked for AI lesions and specimens submitted to approved laboratories for virus isolation. Field surveillance examinations should seek to detect changes in flock health.

Surveillance can be done by:

- integrators carrying out their own surveillance and reporting by telephone;
- local disease control centre officers carrying out regular telephone surveillance of independent premises.

All reports of a decline in health status should be investigated. A standard reporting procedure is outlined in Appendix 4.

Although surveillance will begin immediately around the IP or flock, it will have to be extended very quickly to all other sites where movement of birds, products and contaminated materials might have taken place from the IP. Surveillance of wild birds to determine their potential involvement in the dissemination of the disease may also be attempted.

2.2.4 Treatment of infected birds

The prognosis for birds affected with virulent disease is poor. Those that survive are usually in poor condition and resume laying after a period of several weeks. Treatment is ineffective and inappropriate.

2.2.5 Destruction of birds

Efficient, humane procedures must be employed to kill birds without moving them from the site. Individual birds such as pet birds or those in aviaries are relatively easily destroyed, by neck dislocation. Several gases have been used to kill large numbers of birds. These are: cyanide, methyl bromide, carbon dioxide, exhaust gas and nitrogen. Of these, carbon dioxide and nitrogen are the preferred gases to use for large populations of birds (partly because of their relative lack of toxicity for humans). It is better to remove birds from their cages alive and gas them in an enclosed trailer or container before burial or incineration, as it can be extremely difficult to remove dead birds from cages (see the **Destruction of Animals Manual, Section 3.5**).

2.2.6 Treatment of products and by-products

Refer to Appendix 2 for allowable movements and Appendixes 5 and 6 for information on cooked products.

2.2.7 Disposal

One of the major objectives of the eradication program is prompt and effective disposal of infective material, eg dead birds, eggs, litter, manure, fresh and frozen carcases, plant and equipment and building materials , which cannot be effectively decontaminated. Available methods include burial, incineration, burning and rendering. The removal of very large

numbers of birds in a short time presents environmental and logistic problems considering that a shed full of meat chickens close to market weight represents about 40 tonnes of organic material of which 75% is water. The disposal of litter can also pose special problems as infective virus may be spread with the dust. It will be necessary to wet the surface of the litter with a disinfectant and possibly heap it in mounds under plastic before removal (see the **Disposal Procedures Manual, Section 3.6**).

Burial is the best and perhaps the cheapest option if it can be achieved at the infected site itself. Minimising the distance of transportation of infected material is desirable. However, burial at the site may not be possible because of a lack of a suitable burial site as outlined in the **Disposal Procedures Manual, Section 3.1** and arrangements may have to be made at a place removed from the infected site. A burial place outside an infected premises may be desirable in situations where a number of infected foci would have to be depopulated and decontaminated in a given area and where a common burial site would be more efficient.

Incineration is a good means of safe disposal of infected material. However, incinerators are generally too small to be of any use and may not be near animal facilities. Burning has been used where no burial sites are available. Burning is an expensive method of disposal because of the high water content of the carcase and may also be environmentally unacceptable.

Rendering is a good way of disposal if the plant has the capacity needed and if it is possible to effectively decontaminate the rendering plant afterwards. Private rendering plants may not be willing to handle infected birds and eggs. Infected material would need to be transported from infected sites to the plant.

If infected material must be transported elsewhere for disposal, particular attention should be paid to eliminating factors that will contribute to spread of the virus. For example, truck body trays must be waterproof and all loads carefully covered with tarpaulins to ensure that material cannot be blown out.

2.2.8 Decontamination

The AI virus is susceptible to a wide range of disinfectants including detergents; the best disinfectants are detergents, hypochlorites, alkalis, glutaraldehyde and Virkon. Initial cleaning of organic matter from sheds, equipment, vehicles, and so on, by brushing with a detergent is an essential step before the actual disinfection. Particular attention should be paid to the decontamination of litter. As the AI virus can survive up to 35 days in faecal material, it is necessary to quickly disinfect the surface of the litter and adopt measures such as composting for thermal inactivation of the virus (composting within sheds has some advantages). As most disinfectants are inactivated by organic material, contaminated litter may have to be buried or burned after surface disinfection.

Mechanical means of virus spread/fomites, such as clothing, footwear, crates, feed sacks and egg fillers, should be decontaminated, if possible, or destroyed.

Aerosol application of glutaraldehydes is especially suitable for disinfecting fans and similar equipment. Formaldehyde gas should be used for decontaminating electrical equipment and the final decontamination of hatcheries, if it can be used safely.

For further information see the **Decontamination Manual, Table 2.4**

2.2.9 Vaccination

Vaccination is not an option in the control of avian influenza (see Section 1.5.3 for a complete discussion).

2.2.10 Wild animal control

Wild birds that visit poultry sheds may harbour and shed AI virus. They may introduce AI to an area and have been implicated as the initial cause of AI outbreaks. During the 1985 avian influenza outbreak in Victoria, a virus of the same serotype was isolated from a starling trapped on the infected farm (Morgan and Kelly 1990).

It is essential to bird-proof the quarantined poultry houses and protect contaminated sites from birds during eradication procedures.

For further information see the **Wild Animal Control Manual, in press**.

2.2.11 Vector control

The control of vermin should meet the high standards already expected on a commercial poultry farm. A special control program should be instituted as part of the eradication program to reduce the dispersal of rats and mice from the contaminated site (see also section 1.6.3).

2.2.12 Sentinel and restocking measures

No repopulation can take place until at least 21 days after satisfactory cleaning and disinfection has been completed. Experience in the United States and Australia has shown that dead bird sampling of repopulated sheds is more efficient for monitoring than placing sentinel birds in the buildings from the time of depopulation to repopulation.

2.2.13 Public awareness

A media campaign must emphasise the importance of producers inspecting susceptible animals regularly and of reporting suspicious lesions and unusual deaths promptly (see Appendix 4). Details of any imposed movement controls needs to be available and clearly explained to industry. The public must not be panicked into avoiding poultry products.

2.3 Feasibility of control in Australia

Controlling isolated virulent avian influenza outbreaks in commercial poultry enterprises have been shown to be feasible, with all outbreaks to date having been quickly controlled and the disease eliminated from those establishments.

If the disease is widespread or spreading rapidly, eradication would still be technically feasible, but would be more difficult to justify on economic grounds.

3 POLICY AND RATIONALE

3.1 Overall policy for virulent avian influenza

Virulent avian influenza is an OIE List A disease that is highly lethal to poultry and which is important in the production and trade of poultry and poultry products.

When the Consultative Committee on Exotic Animal Diseases determines the infection is caused by a virulent avian influenza virus, the policy is to eradicate the disease in the shortest possible period while limiting economic impact, using a combination of strategies including:

- ***stamping out,*** **which involves quarantine and slaughter of infected and exposed poultry on infected premises and sanitary disposal of destroyed poultry and contaminated poultry products, to remove the source of infection;**
  - **clinically normal flocks on an infected premises may be commercially processed under supervision as soon as practicable;**
- ***quarantine and movement controls*** **on poultry, poultry products and things in declared areas to prevent spread of infection;**
- ***decontamination*** **of facilities, products and things to eliminate the virus on infected premises and to prevent spread in declared areas;**
- ***tracing and surveillance*** **to determine the source and extent of infection and to provide proof of freedom from the disease;**
- ***zoning*** **to define infected and disease-free areas; and**
- ***a public awareness campaign*** **to facilitate cooperation from industry and the community.**

An uncontrolled outbreak of virulent avian influenza would cause severe production losses with consequent dislocation and financial losses in the poultry industry and associated service and sales industries. It will therefore be necessary to act immediately and effectively to control and then eradicate the disease.

There are low virulence strains of avian influenza that cause negligible (or no) production loss. If such a strain were to be identified in Australia, a modified policy would be applied.

Virulent avian influenza is included in the Commonwealth/States cost-sharing agreement.

The CVO(s) in the State(s)/Territory(s) in which the outbreak(s) occurs will be responsible for implementing disease control measures (in accordance with relevant legislation), and will make ongoing decisions on follow-up disease control measures in consultation with the Consultative Committee on Exotic Animal Diseases (CCEAD), the State/Territory and Commonwealth governments, and representatives of the affected industries. The detailed control measures adopted will be determined using the principles of control and eradication (Section 2) and epidemiological information about the outbreak. For further information on the responsibilities of the State/Territory disease control headquarters and local disease control centre(s), see the **Control Centres Management Manual**.

3.2 Strategy for control and eradication

The objective is to implement disease control strategies that will eradicate the disease from domestic birds and re-establish Australia's virulent avian influenza free status in the shortest possible time-frame. Stamping out is the only acceptable control method with strict quarantine and control measures, appropriate decontamination of material on infected premises, and targeted tracing and surveillance.

Vaccination is not an option.

It will be necessary to ensure regular and ongoing liaison with industry to seek their involvement, with the media to attempt to ensure balanced and factual reporting, and with the public to provide information and clear explanations.

3.2.1 Stamping out

All birds on infected premises will be subject to stamping out if there is clinical disease or evidence of active virulent virus infection. Decisions on the destruction of birds from other premises will be made on the information that becomes available from the tracing, surveillance and pathotyping that will be undertaken. Note that under AUSVETPLAN the definition of an infected premises is a defined area which may be all or part of a property.

3.2.2 Quarantine and movement controls

There will be a declaration of infected premises (IPs), and any dangerous contact premises (DCPs) or suspect premises (SPs). This will be supported by the declaration of two major disease control areas as follows.

- A ***restricted area*** **(RA)** with a radius of 1–5 km around an infected premises and including as many DCPs and SPs as possible; wherever possible the RA will exclude major markets, processing plants and general service areas. More than one RA may be declared.
- A ***control area*** **(CA)** with a boundary no closer to the RA boundary than about 2–10 km will form a buffer between the infected and free areas. This will assist in containing the disease within the RA and will enable a level of restrictions and a reasonable level of commercial activity to continue.

The initial boundary of the CA may correspond with State or other geopolitical borders but this boundary should be amended on the basis of epidemiological obtained over time to allow as much commercial activity as possible, in line with accepted disease control measures .

The IPs and DCPs will be subject to strict quarantine, and movement controls as outlined in Appendix 2. Movements of people and vehicles will be controlled with detailed decontamination being required prior to leaving these premises. Quarantine should take into consideration restricting the access of wild birds to sheds and water supplies. Bird-proofing should commence as soon as possible. Pets should be confined.

The SPs will be subject to strict movement controls while investigations into the status of the premises are being undertaken and during the OIE prescribed incubation period of 21 days. These restrictions will ease as the situation becomes better defined. It is important that restrictions on declared premises be eased as soon as circumstances permit.

There will generally be free movements within the CA of birds, products and things subject to inspection of premises and an upgrading of hygiene in management practices, processing establishments and markets. Movements from the RA and CA into the free area may be permitted subject to permit and, in some specific cases, CVO approval. Birds and products from the free area may enter the CA. Movement restrictions may need to extend to activities such as pigeon racing, poultry and bird shows, pet shops and aviaries.

For further details refer to Appendixes 1 and 2.

Zoning

Zoning should be introduced as soon as possible after the epidemiological investigations have been completed and the extent and severity of the disease has been determined. Zoning requirements must be adequate to meet international standards and OIE guidelines that require a boundary with a radius of 10 km from the centre(s) of infection in intensive livestock production areas and 50 km in extensive areas (OIE Code 1992). The size of the infected zone will approximately equate to the size of the RA and CA combined. The establishment of zoning may permit earlier access to international markets from the free area.

3.2.3 Treatment of infected birds

The treatment of infected birds will not be permitted.

3.2.4 Treatment of poultry products and by-products

Manure and litter disposal may require individual approval and treatment depending on the premises and circumstances.

Detailed policy recommendations are listed in Appendix 2.

3.2.5 Vaccination

On the basis of the efficacy and concerns about current vaccines, vaccination is not an option under current circumstances (see Section 1.5.3).

3.2.6 Tracing and surveillance

Because of the large number of movements of birds, products and services associated with the industry, the task of tracing will be time consuming. It will commence immediately virulent avian influenza is suspected. Tracing will involve movements of birds, products, people, vehicles and materials, to and from the premises, for at least 21 days before the first signs of disease, and until full quarantine is imposed. The original source of the virus should be traced as it could remain a threat.

Surveillance will be undertaken on those premises considered at risk. This will involve the inspection of birds, follow-up on reports of sick birds, examination of flock records, postmortem of dead birds and serological surveys of at-risk and other premises to ascertain the extent of the infection. Backyard premises may be included in the survey. Further information is provided below in Section 3.4

See Appendix 4 for further detail.

3.2.7 Decontamination

The AI virus is susceptible to a wide range of disinfectants but only if proper cleaning has occurred before their use. Buildings, equipment, vehicles, manure and litter will all be subject to cleaning and disinfection, or destruction, on all infected premises. People should also undergo personal decontamination procedures. Decontamination procedures on other premises will be implemented as considered necessary.

Decontamination should include standard insect vector and rodent control to minimise mechanical spread of the agent to nearby premises.

3.2.8 Response to strains of lower virulence

The detection of strains of avian influenza in commercial poultry that are of lesser virulence (as determined by CCEAD) will require a carefully balanced response. This will have to be determined at the time through consultation between the State CVO, the affected enterprise, the Commonwealth, the other States, and the poultry industry generally. Factors which must be considered include:

- the nature and severity of disease caused by the isolate;
- the strain of virus and the risk of mutation to greater virulence;
- the possibility of spread to other commercial poultry;
- the possibility of a mixed population of viruses being present, with apparently non-pathogenic strains masking subpopulations of virulent strains;
- the marketing impacts of the disease; and
- the cost and marketing impacts of response options.

3.3 Social and economic effects

The Australian Bureau of Agriculture and Resource Economics (ABARE) has estimated the gross value of production of the Australian egg industry at $284 million and the chicken meat industry at $845 million (1993/4).

The main losses will be from mortalities, which can be high, and losses due to decreased egg and meat production and reduced productivity. There will be further loss of income for an extended period due to the stamping-out policy. The 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 of the industry and its normal marketing patterns. Infection in grandparent and foundation flocks will cause loss of some valuable genetic material.

Export markets are likely to close, but this period may be reduced by the adoption of a zoning strategy. If the disease is allowed to become widespread and national production is affected, it is possible that domestic supply may not meet demand.

The eradication strategy and movement controls that will be imposed and rigorously enforced, will result in severe disruption to many industry practices including breeding programs and sales of eggs, chicks, pullets and meat birds. Any delays beyond the marketing age of the various commodities can cause major increased production costs and losses over a short period, and affect the programs of producers not directly involved in the outbreak through loss of supply.

Pet shops, aviaries and bird dealers may also be affected through the movement controls.

It is important that restrictions are eased as soon as the circumstances permit within the strategy to prevent spread of the disease, so that a level of viable commerce may recommence for as many premises as feasible as soon as possible. If the veterinary administrators are satisfied that the actions taken are adequate to contain the disease within the declared areas and zoning procedures are in place then all product from the free area should be allowed to move unimpeded (overseas or interstate), and product from the declared areas moved by permit subject to an assessment of the risks involved.

3.4 Criteria for proof of freedom

According to the 1992 OIE Code, a country may be considered free of AI when the disease has not been present for at least the past three years. If the disease occurs in a free country where a stamping-out policy is practised, a period of at least six months must elapse after the occurrence of the last case before the country can be declared free again (see Appendix 3).

In the case of Australia, the policy is one of stamping out by quarantine, slaughter and disposal of all infected material. As such, the earliest Australia would be able to declare itself free of AI would be six months after the last case.

Importing countries may be prepared to accept less than the OIE standards and allow importation of live poultry, hatching eggs and poultry products from Australia. Australia would need to certify that disease is not present in the flocks of origin.

Proof of freedom from AI can best be achieved by clinical observations and dead bird sampling of repopulated sheds and possible disease outbreaks, rather than widespread biological testing.

Some serological surveillance will be required and it is recommended that this should be performed on IPs, DCPs and SPs at 30 days and at 5 months after repopulation to satisfy a 95% confidence of detecting infection at less than 5%. This is to be supported by twice weekly clinical examinations for 30 days then fortnightly for 5 months and virus isolation carried out on dead birds. Seropositive flocks will require further investigation and virus isolation attempts.

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

3.5 Funding and compensation

Virulent avian influenza is included in the list of diseases for which arrangements exist under the Commonwealth/States cost-sharing agreement for the eradication of certain exotic animal diseases. Information on the cost-sharing arrangements can be found in the

AUSVETPLAN **Summary Document** and in the **Valuation and Compensation Manual**.

3.6 Strategy if the disease becomes established

The presence of virulent avian influenza virus is not acceptable in any flock.

While it has been shown that wild birds are reservoirs for AI virus and can be the source of the initial infection, surveys during AI outbreaks in poultry have suggested that wild birds do not disseminate AI virus on a wider scale, where outbreaks are controlled.

Proper hygiene measures can be effective in preventing AI infection of poultry. Coupled with a policy to stamp out infected flocks, government and industry would have to combine in a preventive program incorporating the following features:

- keeping industry informed and consulting with it;
- educating industry about the disease, the control program and the need to maintain good records;
- preventing infection by programs to encourage isolation, bird-proofing of poultry houses, exclusion of other wild life, rodents and family pets, and treatment of drinking water to kill viruses using chlorine or UV light;
- monitoring disease by serological sampling of meat chicken flocks at processing plants (30 samples per flock) and laying flocks on an annual basis;
- rapid reporting of suspicious flocks so that the whole industry can quickly upgrade hygiene and management procedures;
- strict isolation of suspect flocks until they can be confirmed negative or be depopulated; and
- industry/government cooperation to trace the outbreak and to improve on future control strategies.

Vaccination may prevent the development of clinical signs but it does not prevent infection. There is always the possibility for mutation or genetic re-assortment to highly pathogenic strains in vaccinated birds harbouring mildly pathogenic strains. Vaccinated birds continue to excrete virulent virus and it interferes with serological monitoring. Vaccination is therefore not acceptable in Australia until the technology is greatly improved.

APPENDIX 1 Guidelines for classifying declared areas

Infected premises (IP)

A premises classified as an IP will be a defined area (which may be all or part of a property) in which virulent avian influenza disease or a virulent strain of AI virus exists, or is believed to exist. An IP will be subject to quarantine served by notice and to eradication and control procedures.

Dangerous contact premises (DCP)

Premises classified as DCPs will be those that contain birds, poultry products, poultry waste or things that have recently been introduced from an infected premises (usually up to 21 days prior to declaration of the premises being infected) and are likely to be infected or contaminated or any of these items that may have been in substantial contact with people that have been associated with an infected premises within three days of visiting the DCP.

Suspect premises (SP)

Premises classified as SPs will be those that contain birds that have possibly been exposed to an AI virus, such that quarantine and surveillance, but not pre-emptive slaughter, are warranted; OR birds not known to have been exposed to an AI virus but showing clinical signs requiring differential diagnosis.

Restricted area (RA)

An RA will be a relatively small declared area (compared to a *control area*) around infected premises that is subject to intense surveillance and movement controls. Movement out of the area will, in general, be prohibited, while movement into the area would only be by permit. Multiple RAs may exist within one CA.

The RA does not need to be circular but can have an irregular perimeter provided the boundary is initially an appropriate distance from the nearest IP, DCP or SP. This distance will vary with the size and nature of the potential source of virus, but will be approximately 1–5 km around the IP, depending on the density of poultry premises. The boundary could be the perimeter fence of the IP if the IP is in an location. The boundary in a densely populated area will take into account the distribution of susceptible birds and traffic patterns to markets, service areas, abattoirs and areas that constitute natural barriers to movement. If possible hatcheries should be kept out of the RA.

Control area (CA)

The CA will be a larger declared area around the RA(s) and, initially, possibly as large as a State where restrictions will reduce the risk of disease spreading from the RA(s). The boundary of the CA will be altered as confidence about the extent of the outbreak becomes clearer but must remain consistent with the OIE Code. In general, surveillance and movement controls will be less intense and animals and products may be permitted to move under permit from the area.

The declaration of a CA also helps to control the spread of the outbreak from within the RA. The CA is a buffer zone between the RA and the rest of the industry. The boundary does not have to be circular or parallel to that of the RA but should be 2–10 km from the boundary of the RA. In general, movement of possibly contaminated things and materials within the CA is allowed but movement out of the CA is prohibited without CVO approval (see Appendix 2 for details). This type of control area allows commercial activities to continue.

If the CA contains an appropriate place for poultry slaughter, permission should be given to remove meat chickens from DCPs and SPs following inspection within 24 hours for slaughter where no sign of infection has developed during the declared incubation period and surveillance has been in place. This represents a minimum risk of infected birds being removed, a risk that is further reduced by the cooking processes involved in the food chain. If movement is carried out with strict supervision of quarantine and hygiene procedures, this risk should be greatly preferable to the virus 'factory' which would result from the development of clinical disease.

NB When declaring RAs and CAs, the areas must not be larger than necessary, thus restricting the number of properties to be quarantined to only those deemed prudent. If flocks in a quarantine area are not depopulated, then the cost of keeping the birds beyond their normal market age could be substantial.

International considerations

Under OIE definitions an *infected zone* means a clearly defined territory in which a disease (listed in the *code*) has been diagnosed. This area must be clearly defined and decreed by the veterinary authorities in accordance with the environment, the different ecological and geographical factors as well as all the epizootiological factors and the type of husbandry being practised. The territory in question should have a radius of at least 10 km from the centre or centres of the disease in areas with intensive livestock raising and 50 km in areas where extensive livestock raising is practised.

In June 1993 the European Commission published a decision laying down the criteria for classifying Third Countries with regard to avian influenza and Newcastle disease. Annex C point 4 of this decision states:

Around confirmed outbreaks of disease a protection zone with a minimum radius of 3 km and a surveillance zone with a minimum radius of 10 km shall be implemented. In these zones stand still measures and controlled movements of poultry shall be in force until at least 21 days after the end of disinfection operations on the infected holding. Before lifting the measures in these zones the authorities shall carry out the necessary inquiries and sampling of the poultry holdings to confirm that disease is no longer present in the region concerned.

APPENDIX 2 Recommended quarantine and movement controls

Infected premises and dangerous contact premises	Suspect premises
Movement out of susceptible birds:	
Prohibited for all susceptible birds in groups showing clinical disease. To be slaughtered on-site. Other non-clinical groups on the farm after negative surveillance may be slaughtered off-site under supervision and the product heat treated (1).	May be moved under permit for slaughter off-site under supervision after negative surveillance including serological testing. (1)
Movement in of susceptible birds:	
Prohibited.	Allowed by permit. Subject to surveillance (2).
Movement out of other animals:	
All avian species prohibited. Other animals allowed by permit.(3).	Allowed by permit.
Movement out of litter and manure:	
Prohibited	Prohibited
Movement out of equipment and feed:	
Prohibited except by permit (7)	Prohibited except by permit
Movement in and out of people:	
Allowed by permission. Subject to strict disinfection procedures.	Allowed subject to strict disinfection procedures.
Movement in and out of vehicles:	
Subject to security and decontamination arrangements in place at the premises.	Allowed by permit subject to strict quarantine and disinfection procedures.
Movement of fertile eggs:	
To be destroyed on the place except for salvage of genetic stock under strict controls and previously approved protocols on handling procedures.	Allowed by permit subject to disinfection and transport procedures.

Movement of table eggs:

Allowed by permit subject to prescribed sanitisation procedures, otherwise destroyed on-site.	Allowed by permit, subject to prescribed sanitisation procedures.

Movement of fresh/frozen meat and offal from susceptible birds:

Prohibited if from the groups showing clinical signs. To be destroyed on the place or according to the CVO. Allowed by permit if from non-clinical groups, for heat processing under supervision (if necessary outside the RA). Vehicles used must be thoroughly cleaned and disinfected immediately after use (4).	Fresh/frozen retail sales allowed except when birds have not been inspected prior to slaughter. Allowed by permit to be further processed or cooked, if necessary, outside the RA. Vehicles used must be cleaned and disinfected immediately after use (4).

Movement in of feed:

Allowed by permit to supply feed to remaining birds on a DCP (5).	Allowed by permit, subject to strict quarantine and decontamination procedures (5).

Movement of abattoir waste:

Operations suspended. Waste buried on site or removed on permit subject to decontamination procedures for approved disposal (6).	Allowed by permit within the RA subject to decontamination procedures (6).

Movement out of dead birds:

Dispose of on place or in RA by permit subject to strict quarantine and disinfection for approved disposal.	Allowed by permit within the RA.

Movement out of horticultural and agricultural crops:

Unrestricted movement.	Unrestricted movement.

Restricted area	**Control area**

Movement out of susceptible birds:

Prohibited.	Prohibited, except by permit.

Movement in of susceptible birds:

Movement from a free area or contiguous CA to an abattoir for immediate slaughter is allowed by permit. Restocking of specified premises is permitted.	Movement from a free area to a property or abattoir is allowed by permit.

Movement within of susceptible birds:

Movement to an abattoir for immediate slaughter or to a farm for restocking may be allowed by permit (1).	Movement is allowed within the CA.

Movement out of, litter and manure:

Prohibited	Prohibited except by permit

Movement out of feed and equipment:

Allowed by permit (7)	Allowed

Movement through of susceptible birds:

Direct movement by air, road or rail may be allowed by permit, provided the origin and destination are both outside the RA and CA, and the birds are not unloaded within the declared areas. If transport is delayed within the RA, the birds should be regarded as suspect and their further movement carefully reassessed.	As for RA.

Risk enterprises, eg private avian laboratories, cull hen collectors, dead bird pick-ups, etc (not processing establishments):

Operations suspended.	May continue to operate by permit.

Sales, shows, pigeon races, etc:

Concentrations of susceptible birds may be allowed subject to permit.	May continue to operate by permit.

Movement of meat, offal and waste from susceptible birds:

Movement into or within the RA is allowed. Movement out of the RA is allowed to approved premises by permit and subject to heat treatment.	Movement into or within the CA is allowed. Movement out of the CA may be allowed by permit, preferably after heat treatment.

Movement of table eggs in or out:

Allowed by permit subject to sanitisation procedures.	Allowed into, within or out of the CA by permit. Allowed by permit into the RA.

Movement of fertile eggs:

Not allowed from infected flocks except for genetic salvage by permit. Allowed from other flocks by permit subject to strict quarantine, disinfection, subsequent surveillance and transport procedures.	Allowed within the CA. Allowed by permit to outside the CA subject to upgraded hygiene procedures and subsequent surveillance. Movement allowed by permit.

Movement of egg pulp from plants including on farm plants:

Allowed under permit for heat treatment within the RA or CA.	Allowed within the CA. Permit required to move outside the CA.

Control of domestic pets and poultry:

Within the RA, all free poultry to be confined.	Within the CA, all free poultry to be confined.

NOTES:

(1) If the CA contains an appropriate place for poultry slaughter, permission should be given to remove meat chickens from DCPs and SPs following inspection within 24 hours for slaughter where no sign of infection has developed during the declared incubation period and surveillance has been in place. This represents a minimum risk of infected birds being removed, a risk that is further reduced by the cooking processes involved in the food chain. If movement is carried out with strict supervision of quarantine and hygiene procedures, this risk should be greatly preferable to the virus 'factory' which would result from the development of clinical disease.

(2) Permits for movement of susceptible birds on to an SP or into an RA or CA should be issued with caution. Although such movements may pose no risk of spreading infection, compensation would be payable if these animals became infected. Birds must remain on the property for at least 21 days and be inspected before any further movement, or be immediately processed. Birds must be a single delivery from an AI-free source that has adopted upgraded hygiene measures.

(3) Stock must not have had direct contact with poultry for 21 days prior to movement.

(4) If a processing plant has received birds from an IP, DCP or SP since the critical date, the plant will be cleaned and decontaminated, under supervision, before operating again. Staff must undergo disinfection procedures before leaving the premises. Advice must be given to staff for poultry, cage and aviary birds or pigeons kept at home.

(5) Disinfect vehicle on site, at a central point or back at the mill.

(6) The refuse must be buried at an approved site and the vehicle cleaned and disinfected. The refuse must not be fed to or brought into contact with other birds.

(7) Feed that has been exposed to susceptible birds should be prohibited from leaving the premises

APPENDIX 3 OIE International Animal Health Code for fowl plague [avian influenza]

[NB The following text is taken directly from the OIE International Health Code (1992); Chapter 2.1.14. For definitions, Appendixes, etc see the original text. The OIE Codes are amended every year in May. There have been no amendments to the code for AI in 1993, 1994 or 1995.]

Preamble: For diagnostic tests and vaccine standards, reference should be made to the *Manual* (A16) [☞see OIE publications under References].

Definition

Fowl plague (FP) is a disease of poultry caused by any serotype of avian influenza A, which has a significant pathogenicity in laboratory tests. A suitable test is to inoculate eight healthy 4–8-week-old susceptible chickens with bacteria-free infected allantoic or cell-culture fluid, and observe for up to eight days. Virus of a pathogenicity sufficient to be designated fowl plague will cause at least 75% mortality.

The definition of fowl plague is based on the recommendations of the International Symposium on Avian Influenza, Beltsville, Maryland, USA, April 1981. This meeting also recommended that the term fowl plague should be discarded, except for historical purposes. It was agreed that this should be done when a suitable alternative name has been accepted internationally.

Article 2.1.14.1.

For the purpose of this Code, the incubation period for fowl plague (FP) shall be 21 days.

Article 2.1.14.2.

For the purposes of this *Code:*

FP: ***free country***

A country may be considered free from FP when it has been shown that FP has not been present for at least the past three years.

This period shall be six months after the occurrence of the last *case* for countries in which a *stamping-out* policy is practised, with or without vaccination against FP.

FP: ***infected zone***

A FP infected zone shall be considered as such until at least 21 days have elapsed after the last case has been reported and following the completion of a stamping-out policy and disinfection procedures, or six months after the clinical recovery or death of the last affected animal if a stamping-out policy is not practised.

Article 2.1.14.3.

Veterinary Administrations of *importing countries* should require similar arrangements to those provided in Chapter 2.1.15. (Newcastle disease) of this *Code* for:

1) domestic and wild birds;
2) day-old chicks, turkey poults and other newly-hatched avian species;
3) hatching eggs
4) *semen* of domestic and wild birds;
5) *fresh meat* of domestic and wild birds;
6) *products of animal origin* (from birds) *destined for use in animal feeding or for industrial use;*
7) *pathological material* and *biological* products (from birds) which have not been processed to ensure the destruction of FP virus.

APPENDIX 4 Procedures for surveillance and proof of freedom

Intensive surveillance aims to identify potential new cases of AI. Because of the risk of spread of virus by inspectors, the following procedures should be adopted to minimise multiple farm inspections:

- industry reporting on flocks by telephone or facsimile;
- telephone survey;
- serological testing;
- dead bird pick up (DBPU) and transport to a laboratory; and
- visits to potential new cases only identified by the above.

There are three phases:

- early in an outbreak;
- later in an outbreak when recovered flocks have seroconverted; and
- if the disease is established.

Training needs

Surveillance officers must be:

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

Surveillance officers must have access to:

- flock health records expected for the class of stock under normal circumstances;
- a summary of the disease — a list, pictures and video of clinical signs and an example of how health and production records would change in flocks infected with exotic ND virus or AI.

Information required

Information from records and from the owner/staff will be required from high risk flocks in the RA and CA. These could be:

Poultry:	**Other:**
breeders	pigeons
started pullets	aviaries
layers	pet shops
meat chickens	
turkeys	
game birds	
backyard flocks	
fancy flocks	

Information related to flock health will be needed, for example:

- any decline in
  - feed and/or water consumption
  - egg production
  - hatchability
- any increase in
  - mortality

  - wet droppings

- any increase in prevalence of
  - respiratory disease
  - depressed birds
  - swollen heads, shanks or feet
  - nervous signs
  - wet droppings

Field autopsy findings, which include any of the following:

- severe swelling of combs and wattles;
- cyanosis of the comb;
- haemorrhage and necrosis of the comb;
- periorbital oedema;
- swelling of the shanks and feet;
- petechial haemorrhages on the viscera;
- catarrhal tracheitis;
- tracheal oedema;
- petechial tracheal haemorrhages; and
- caseous tracheal exudate.

Decisions should be made locally on which laboratory will be responsible for the laboratory testing and who will manage the system and evaluate the results for the situations described below.

Procedures during the outbreak

In the RA. Arrangements should be made for local laboratories to autopsy samples of all species of bird that are found dead. Flock health can be monitored by:

- twice weekly (or more frequently if needed) reporting by telephone/facsimile by integrators and DBPU, with field visit if needed;
- twice weekly (or more frequently if needed) telephone surveillance of SPs and DBPU, and field visit if needed; and
- immediate serological testing of breeding flocks (paired samples[1] two weeks apart, then weekly).

In the CA. Flock health can be monitored by:

- paired serological samples two weeks apart, then weekly serological sampling of breeding flock;
- serological sampling of meat chickens and commercial spent hens at abattoirs;
- weekly telephone surveillance of susceptible flocks including the other species; and
- weekly reporting on flock health by integrators.

Procedures to establish proof of freedom

Proof of freedom from AI can best be achieved by clinical observations and dead bird sampling of repopulated sheds and possible disease outbreaks, rather than widespread biological testing.

[1] Samples collected from the same bird two weeks apart.

Some serological surveillance will be required and it is recommended that this should be performed on IPs, DCPs and SPs at 30 days after repopulation and at 5 months to establish a 95% confidence of detecting infection at less than 5%. This is to be supported by twice weekly clinical examinations for 30 days then fortnightly for 5 months and virus isolation carried out on dead birds. Seropositive flocks will require further investigation and virus isolation.

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

APPENDIX 5 Extract from a submission to the Animal Health Committee Meeting No. 36, October 1985, by the Australian Poultry Industries Association

PRE-AGREEMENT

Discussion

Guidelines for the treatment and distribution of cooked poultry products in the event of an outbreak of exotic diseases.

Preamble

1. The objective of quarantine of a given premises or geographic area within which an exotic disease has been suspected or diagnosed is to reduce the risk of spread of that disease.
2. There is considerable, and increasing, interstate trade in cooked poultry products with a strong trend towards the establishment of large, highly specialised, capital intensive plants supplying a limited range of cooked products throughout Australia. It is anticipated that this trend will accelerate in the future. Total bans on the movement of all poultry and poultry products such as occurred in the recent Victorian AI outbreak could have a devastating effect on such plants.
3. In the category of cooked products as defined above are included primary poultry products such a roast and smoked poultry; further processed products such as poultry nuggets, poultry rolls; secondary products such as poultry stock cubes, soup mixes, and other products such as canned and dried pet foods which often rely heavily on poultry ingredients.
4. Provided that certain guidelines on the treatment of such products are followed they will not represent a quarantine risk.

Guidelines

1. The poultry used to prepare such products may not be derived from infected premises or dangerous contact premises.
2. The cooked poultry plant must observe a high degree of quarantine to ensure no contact with infected premises.
3. The cooking process must ensure that a temperature sufficient to kill the exotic disease virus is achieved at all points within the cooked product. In the case of avian influenza a temperature of 71°C must be achieved. In the case of Newcastle disease, a temperature of 80°C must be achieved.
4. Prior to authorisation being given to distribute cooked product, the plant and process must be inspected by an authorised inspector of the State Department of Agriculture. Plant management must furnish the inspector with whatever proofs of the constancy and reliability of the process that he may require.
5. Cooked product must be despatched in clean sealed vehicles. Raw poultry products must not be distributed in the same vehicle.

GLOSSARY

Anamnestic response	The immunological response that occurs on re-exposure to an antigen that has previously invoked an immunogenic response.
ANEMIS	*AN*imal Health *Em*ergency *I*nformation *S*ystem. A system for the collection, assimilation, actioning and dissemination of essential disease control information using paper documentation and ADP assistance.
Animal by-products	Products of animal origin destined for industrial use, eg raw hides and skins, fur, wool, hair, feathers, hooves, bones, fertiliser.
Animal products	Meat products and products of animal origin (eg eggs, milk) for human consumption or for use in animal feeding.
AUSVETPLAN	A series of documents that outline the Australian approach to the eradication/control of the more important animal diseases not presently occurring in this country; linking policy, strategies, implementation, coordination and emergency-management plans.
Chief veterinary officer	The veterinary officer of a State or Territory animal health authority who has responsibility for animal disease control in that State or Territory.
Colibacillosis	Neonatal infection with *E.coli* bacteria.
Consultative Committee on Exotic Animal Diseases	A committee of State/Territory CVOs, AAHL and CSIRO, chaired by the CVO of Australia (Cwlth DPIE), to consult in emergencies due to the introduction of an exotic disease of livestock, or serious epizootics of Australian origin.
Control area	A bigger area than a restricted area (possibly as big as a State) where restrictions will reduce the chance of the disease spreading further afield (*see* Appendix 1).
Coryza	A contagious disease of birds (especially. poultry) characterised by the secretion of a thick mucous in the mouth and throat.
Critical date	The critical date is the earliest time AI virus entered the premises. The critical date is determined by the CVO in consultation with laboratory staff and epidemiologists and should be consistent with the apparent incubation period of the current outbreak.
Cyanosis (adj. cyanotic)	Blueness of the skin and/or mucous membranes due to insufficient oxygenation of the blood.
Dangerous contact bird	A bird showing no clinical signs of disease but which, by reason of its probable exposure to disease, will be subjected to disease control measures (which may require slaughter of all or some of such birds). (*see also* Suspect animal)

Dangerous contact premises	Premises containing dangerous contact birds (*see* Appendix 1).
Declared area	A defined tract of land for the time being subject to disease control restrictions under exotic disease legislation. Types of declared areas include *restricted area; control area; infected premises;* and *dangerous contact premises.*
Depopulation	The humane slaughter and disposal of flocks on IPs and exposed flocks on DCPs.
Disinfectant	An agent used to destroy microorganisms outside a living animal.
Disposal	Sanitary removal of animal carcases and things by burial, burning or some other process so as to prevent the spread of disease.
E.coli cellulitis	Inflammation and swelling within tissue due to infection with the bacterium *E.coli.*
Ecchymotic haemorrhages	Small round spots or purplish discolouration caused by bleeding or bruising in the skin or mucous membrane.
Egg marketing premises	A premises where table eggs are graded and packed for the retail market. The premises may also contain a pulp plant and facilities for manufacture of egg-based products.
Egg pulp	A homogenous liquid made from either whole liquid egg, egg albumen or egg yolk, pasteurised for marketing as a liquid or frozen product.
ELISA	Enzyme-linked immunosorbent assay — 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.
Emergency	Requiring an immediate response and highest priority for allocation of resources.
Exotic animal disease	Disease affecting animals (which may include humans) and that does not presently occur in Australia.
Fomites	Inanimate objects (eg boots, clothing, equipment, vehicles, crates, packagings) that can carry the exotic agent and spread the disease through mechanical transmission.
Fowl cholera	An acute septicaemia of domestic fowl and other birds caused by *Pasteurella* bacteria.
Fowl plague	Avian influenza (*see* Appendix 3).
Further processing plant	A plant that receives fresh carcases from an abattoir for cutting up, processing into poultry nuggets, rolls etc and cooked or partially cooked for fast food outlets and retail markets.
Galliformes (adj. gallinaceous)	The order of birds that includes the domestic fowl, turkey, pheasant and peafowl.

Haemagglutinin (vb: haemagglutinate)	Substance that agglutinates red blood cells.
Incubation period	The period which elapses between the introduction of the pathogen into the animal and the occurrence of the first clinical signs of the disease.
Infected premises	A defined area (which may be all or part of a property) in which an exotic disease exists, is believed to exist, or in which the infective agent of that exotic disease exists or is believed to exist. An infected premises is subject to quarantine served by notice and to eradication or control procedures.
Integrator	An individual or party who owns poultry on two or more premises and usually owns feed mills and processing plants.
Local disease control centre	An emergency operations centre responsible for the command and control of field operations in a defined area.
Movement control	Restrictions placed on movement of animals, people and things to prevent the spread of disease.
Mycoplasmosis	Infection with *Mycoplasma* organisms, eg chronic respiratory disease of fowl.
Pasteurellosis	Disease resulting from infection with bacteria of the genus *Pasteurella* that often produces swelling of comb and wattle in association with respiratory symptoms.
Peritoneum	The thin layer of cells lining the exterior of the abdominal organs and the interior of the abdominal wall
Petechial haemorrhage	Tiny, flat, red or purple spots in the skin or mucous membrane caused by bleeding from small blood vessels.
Peracute	Extremely acute form of a disease
Poultry products	*see* Animal products.
Poultry by-products	*see* Animal by-products.
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.
Processing plant	An abattoir for slaughtering poultry for human consumption, with chilled and frozen storage facilities.
Proventriculus	the glandular stomach of the bird
Psittaciformes (adj. psittacine)	the bird order of parrots and related groups of birds.
Quarantine	Legal restrictions imposed on a place, animal, vehicle or other things limiting movement.
Restricted area	A relatively small, declared area in which defined rigorous conditions apply to the movement into, out of, and within, of specified animals, persons or things (*see* Appendix 1).

Risk enterprise	A livestock or livestock-related enterprise with a high potential for disease spread, eg an abattoir, milk factory, artificial breeding centre or livestock market.
Sentinel animals	Animals of known health status monitored for the purpose of detecting the presence of a specific exotic disease agent.
Septicaemia	Infection of blood stream with bacteria.
Seroconversion	the change from a negative to a positive antibody status as determined by a serology test.
Stamping out	Eradication procedures based on quarantine and slaughter of all infected animals and animals exposed to infection.
State/Territory disease control headquarters	The emergency operations centre that directs the disease control operations to be undertaken in the State/Territory.
Surveillance	A systematic program of inspection and examination of animals or things to determine the presence or absence of an exotic disease.
Susceptible species	Animals that can be infected with the disease (for AI — all avian species).
Suspect birds	A bird that may have possibly been exposed to an exotic disease such that its quarantine and intensive surveillance, but not pre-emptive slaughter, is warranted; OR a bird not known to have been exposed to a disease agent but showing clinical signs requiring differential diagnosis.
Suspect materials or things	Materials or things suspected of possibly being contaminated by an exotic disease agent.
Suspect premises	Premises containing suspect birds (*see* Appendix 1).
Tracing	The process of locating animals, persons or things that may be implicated in the spread of disease.
Transudate	A passive effusion of fluid from blood vessels, that does not clot outside the body.
Vector	A living organism (frequently an arthropod) that transmits an infectious agent from one host to another. A *biological* vector is one in which the infectious agent must develop or multiply before becoming infective to a recipient host. A *mechanical* vector is one that transmits an infectious agent from one host to another but is not essential to the life cycle of the agent.
Viraemia	The presence of viruses in the blood.
Zoning	The process of defining disease-free and infected zones, based on geopolitical boundaries and surveillance, in accord with OIE guidelines, in order to facilitate trade.

Abbreviations

AAHL	CSIRO Australian Animal Health Laboratory, Geelong
AGDP	Agar gel diffusion precipitin test
AI	Avian influenza
ANEMIS	*An*imal health *em*ergency *i*nformation *s*ystem
AQIS	Australian Quarantine and Inspection Service
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
CA	Control area
CAB	Cage and aviary birds
CCEAD	Consultative Committee on Exotic Animal Diseases
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CVO	Chief veterinary officer
DBPU	Dead-bird pick up
DCP	Dangerous contact premises
ELISA	Enzyme-linked immunosorbent assay
EM	Electron microscopy
H	Haemagglutinin antigens
HI	Haemagglutination inhibition
IP	Infected premises
N	Neuraminidase antigens
ND	Newcastle disease
OIE	World Organisation for Animal Health [Office International des Epizooties]
PCR	Polymerase chain reaction
RA	Restricted area
SP	Suspect premises
SPF	Specific pathogen free

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