Generic import risk analysis (IRA) for uncooked chicken meat

Issues Paper

July 2001

Foreword

Contents

GLOSSARY OF TERMS AND ABBREVIATIONS

AAHL	Australian Animal Health Laboratory
AAS	Avian adenovirus splenomegaly disease
AAV	Avian adenovirus
ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
AEIA	Australian Egg Industry Association
AFFA	Department of Agriculture, Fisheries and Forestry – Australia
AI	Avian influenza
AIV	Avian influenza virus
ALOP	Appropriate level of protection
AQIS	Australian Quarantine and Inspection Service
AUSVETPLAN	Australian Veterinary Emergency Plan
AVA	Australian Veterinary Association
CAA	Chicken anaemia agent
CIA	Chicken infectious anaemia
CIAV	Chicken infectious anaemia virus
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DRA	Designated Risk Area
DVE	Duck virus enteritis
DVEV	Duck virus enteritis virus
DVH	Duck virus hepatitis
DVHV	Duck virus hepatitis virus
EDS 76	Egg drop syndrome
EA	Department of Environment Australia
EEE	Eastern equine encephalomyelitis
EU	European Union
GATT	General Agreement on Trade and Tariffs
HPAI	Highly pathogenic avian influenza
IB	Infectious bronchitis
IBD	Infectious bursal disease
IBDV	Infectious bursal disease virus
IBV	Infectious bronchitis virus
ILT	Avian infectious laryngotracheitis
ILTV	Avian infectious laryngotracheitis virus
IRA	Import risk analysis

JE	Japanese encephalitis
MD	Marek's disease
MDV	Marek's disease virus
Meat	the whole or part of the carcass of any buffalo, camel, cattle, deer, goat, hare, pig, poultry, rabbit or sheep, slaughtered other than in the wild state, but does not include avian eggs or foetuses or parts of foetuses.
Meat flesh	skeletal muscle meat, including any attached fat, connective tissue, nerve, blood, blood vessels and, in the case of poultry, skin.
NAHIS	National Animal Health Information System
NAQS	Northern Australia Quarantine Strategy
ND	Newcastle disease
NDV	Newcastle disease virus
Offal	meat other than meat flesh and includes blood, brain, heart, kidney, liver, pancreas, spleen, thymus, tongue and tripe.
OIE	Office International des Epizooties
Poultry	any avian species.
QB	Quail bronchitis
QBV	Quail bronchitis virus
SOP	Standard Operating Procedures
SPS	Sanitary and Phytosanitary
SPS Agreement	Agreement on the Application of SPS measures
TRT	Turkey rhinotracheitis
TRTV	Turkey rhinotracheitis virus
USA	United States of America
vvIBDV	very virulent infectious bursal disease virus
VEE	Venezuelan equine encephalomyelitis
WEE	Western equine encephalomyelitis
WNV	West Nile virus
WTO	World Trade Organization

EXECUTIVE SUMMARY

This Issues Paper contains the following sections:

1. Introductory discussions of the background to this import risk analysis (IRA), administration issues, the Australian frameworks for quarantine policy and for import risk analysis, the international framework for trade in animal- and plant-derived products, and Australia's current policy for uncooked chicken meat.

2. An outline of the methodology for, and results of, hazard identification

The Issues Paper will be followed by draft and final IRA Reports, each containing the methods for, and results of, risk assessment and risk management. The final IRA Report will also describe quarantine conditions for uncooked chicken meat.

BACKGROUND TO THIS IMPORT RISK ANALYSIS

This import risk analysis (IRA) is being undertaken in response to requests from the Governments of the USA, Denmark, Thailand and New Zealand for access of fresh frozen chicken meat into Australia.

Until relatively recently, the importation of live birds, poultry meat and most poultry products into Australia was prohibited. Only canned poultry products, which met specified requirements in their preparation, were permitted. Conditions for cooked uncanned poultry meat from New Zealand, which has a similar disease situation to Australia, were developed after many years of negotiations, and were promulgated on 12 December 1989. Conditions for the import of cooked uncanned chicken from other countries were promulgated in 1998, although to date, no imports have occurred under these conditions. The import of fresh or frozen chicken meat is currently not allowed from any country.

Progress of the present IRA has been notified to stakeholders as follows:
Animal Quarantine Policy Memorandum (AQPM) 1998/97 sought comment on the proposed approach to the IRA. Comments received indicated that the IRA should be conducted using the non-routine approach. AQPM 1999/68 invited comment on the scope of the IRA and membership of the risk analysis panel (RAP) which will undertake the IRA. After consideration of comments received, the Executive Director of the Australian Quarantine and Inspection Service (AQIS) confirmed the non-routine approach for this IRA and nominated members for the risk assessment panel. This decision was notified to stakeholders in AQPM 2000/23. Appeals were received against the membership of the risk analysis panel, and after due consideration, these were rejected by the Secretary of the Department of Agriculture, Fisheries and Forestry – Australia (AFFA).

ADMINISTRATION

Timetable

Members of the RAP believe that due to the complex nature of the issues to be covered, it is unrealistic to publish a timetable beyond the immediate next steps. The Panel expects to meet again following the expiration of the 60-day comment period after publication of the Issues Paper. A more detailed timetable will be provided following consideration of comments received.

Scope

This IRA considers quarantine risks that may be associated with the importation to Australia of uncooked chicken meat (including irradiated chicken meat) from any country. In this IRA, uncooked chicken meat is defined as the whole or part of the carcass of any domestic chicken (*Gallus gallus*), (but excluding the head, feathers, and all offals other than the liver, heart, gizzard, neck and feet), which has been slaughtered in an abattoir that meets standards at least equivalent to those contained in the "Australian Standard for Hygienic Production of Poultry Meat for Human Consumption", and which has not been subject to processing by heating.

Risk Analysis Panel

The membership of the RAP is as shown in the table below.

Name	**Organisation/Position**	**Expertise**
David Banks *(Chair)*	Animal Biosecurity	animal quarantine policy/ practice; international trade obligations
Andrew Turner	Consultant	avian disease, exotic disease control
Harvey Westbury	AAHL	avian disease, epidemiology and poultry research
Peter Coloe	RMIT	food microbiology
Paul Gilchrist	Consultant	avian disease

Technical Working Group(s)

The RAP has so far not appointed any Technical Working Groups to this IRA. The members of the RAP reserve the right to request the assistance of one or more TWGs in future, should the need arise.

Other anticipated assessments

Biosecurity Australia has commissioned a member of the RAP to conduct a literature review covering the susceptibility of migratory waterfowl and other native and feral bird species to avian influenza virus, Newcastle disease virus and infectious bursal disease virus. This information is relevant to the assessment of likelihood of establishment and spread of these viruses, following possible importation with chicken meat.

It is also expected that there will be a need for assessments of the potential economic impacts of outbreaks of NDV, very virulent infectious bursal disease virus (vvIBDV) and multi-drug resistant bacterial pathogens.

Biosecurity Australia has commissioned research to be undertaken at the Australian Animal Health Laboratory (AAHL) at Geelong, on the transmissibility of infectious bursal disease virus (IBDV) in chicken meat derived from commercial vaccinated broiler birds.

QUARANTINE FRAMEWORK IN AUSTRALIA

Legislative and conceptual framework

AFFA's objective is to adopt quarantine policies that provide the health safeguards required by government policy in the least trade-restrictive way and that are, wherever appropriate, based on international standards. In developing and reviewing quarantine policies, disease risks associated with importations are analysed using IRA, a structured, transparent and science-based process.

The *Quarantine Act 1908*[1] and its subordinate legislation, including Quarantine Proclamation 1998 (QP 1998)[2] are the legislative basis of human, animal and plant quarantine in Australia. The Quarantine Amendment Act 1999, which commenced in June/July 2000, is a major revision to the Quarantine Act.

Section 4 of the Quarantine Act defines the scope of quarantine as follows:

*In this Act, **quarantine** includes, but is not limited to, measures:*

(a) for, or in relation to, the examination, exclusion, detention, observation, segregation, isolation, protection, treatment and regulation of vessels, installations, human beings, animals, plants or other goods or things; and

(b) having as their object the prevention or control of the introduction, establishment or spread of diseases or pests that will or could cause significant damage to human beings, animals, plants, other aspects of the environment or economic activities.

Subsection 13(1) of the Quarantine Act provides, among other things, that the Governor-General in Executive Council may, by proclamation, prohibit the importation into Australia of any articles or things likely to introduce, establish or spread any disease or pest affecting persons, animals or plants. The Governor-General may apply this power of prohibition generally or subject to any specified conditions or restrictions.

For articles or things prohibited by proclamation, the Director of Animal and Plant Quarantine may permit entry of products on an unrestricted basis or subject to

compliance with conditions, which are normally specified on a permit. An IRA provides the scientific and technical basis for quarantine policies that determine whether an import may be permitted and, if so, the conditions to be applied.

The matters to be considered when deciding whether to issue a permit are set out in section 70 of QP 1998 and include the quarantine risk, whether the imposition of conditions would be necessary to limit the quarantine risk to a level that would be acceptably low, and anything else that is considered relevant. 'Quarantine risk' means the likelihood of the importation leading to the introduction, establishment or spread of a disease or a pest in Australia, the likelihood that harm will result (to humans, animals, plants, the environment or economic activities) and the likely extent of any such harm.

The actions of the Director of Animal and Plant Quarantine or his delegate in reaching a decision under the Quarantine Act take into account the risk of significant harm to the environment. The recent amendments to the Quarantine Act introduced new procedures for decisions affecting the environment and clarified arrangements between quarantine decision-making and environment protection legislation, in particular the *Environment Protection and Biodiversity Conservation Act 1999*.

The new procedures will formalise the existing consultation processes with the Department of Environment Australia (EA). They include formal notification of the Environment Minister that consideration is being given to making a decision (the implementation of which is likely to result in significant harm to the environment) and the risk assessment process to be followed. Preliminary findings of the risk assessment will also be notified to the Environment Minister. Any advice received from the Environment Minister will be considered in making a decision and the Environment Minister will be informed of how the advice was taken into account.

In consultation with EA, AFFA is also developing guidelines to assist quarantine officers when making decisions to ensure that the likely effects on the environment are taken into account. Decisions made by AQIS to permit the entry of animal products, made under the Quarantine Act and consistent with Australia's conservative approach to risk, are unlikely to lead to significant adverse effects on the environment. As a routine, EA has been given the opportunity to comment on proposals to develop new quarantine policies.

This IRA provides the basis for consideration of import applications in relation to the importation of uncooked chicken meat. In keeping with the scope of the Quarantine Act, only factors relevant to the evaluation of quarantine risk (ie the risk associated with the entry, establishment and spread of unwanted pests and diseases) are

considered in the IRA. Questions related to the potential economic consequences of importation (other than the impact of a pest or disease incursion) are not part of AFFA's process of evaluation in the context of quarantine policy.

IRA framework

In 1996, the Quarantine Review Committee, chaired by Professor Malcolm E. Nairn, conducted a detailed independent review[3] and, *inter alia*, made recommendations on the process of carrying out IRAs. The Government's response[4] noted that 'risk analysis is the foundation stone on which all quarantine policy and action must be built' and agreed with the Review Committee's six principles that should apply to IRA. The Committee recommended that IRA should be:

- conducted in a consultative framework;
- a scientific process and therefore politically independent;
- a transparent and open process;
- consistent with both government policy and Australia's international obligations;
- harmonised through taking account of international standards and guidelines; and
- subject to appeal on the process.

In order to achieve a consistently objective and defensible method, import risk analyses carried out by Biosecurity Australia follow the principles laid out in the AQIS publication, *The AQIS Import Risk Analysis Process: A Handbook* (AQIS 1998). This process is consistent with Australia's obligations under the SPS Agreement, and relevant recommendations of the Office International de Epizooties (OIE). Copies of the Handbook may be obtained from Biosecurity Australia, or viewed on the AFFA homepage.[5]

Proposals requiring an IRA - those involving significant variations in established policy - are addressed via either the routine or non-routine process. Less complex changes to or reviews of established policy are handled through the former process while the non-routine process is applied where there are potentially significant quarantine risks to be evaluated (not previously studied by Biosecurity Australia/AQIS) and where the analysis is likely to be large and technically complex.

The OIE International Animal Health Code states that:

The principal aim of import risk analysis is to provide importing countries with an objective and defensible method of assessing the disease risks associated with the importation of animals, animal products, animal genetic material, feedstuffs, biological products and pathological material.

According to the OIE International Animal Health Code, import risk analysis should be based on the following steps:

- Hazard identification:
- Risk assessment, comprising
  - Release assessment
  - Exposure assessment
  - Consequence assessment
  - Risk estimation
- Risk management

INTERNATIONAL FRAMEWORK

World Trade Organization

As a member of the World Trade Organization (WTO), Australia has certain rights and obligations under the WTO Agreement, including the Agreement on the Application of Sanitary and Phytosanitary Measures - the so-called 'SPS Agreement'. The SPS Agreement recognises the standards, guidelines and recommendations developed by the Office International des Epizooties (OIE, or world organisation for animal health) for animal health and zoonoses as the relevant international benchmark. Under the SPS Agreement, measures put in place by a country must be based either on an international standard or upon a scientific risk analysis. A risk analysis must:

- Identify the diseases whose entry, establishment or spread within its territory a WTO member wants to prevent, as well as the potential biological and economic consequences associated with the entry, establishment or spread of these diseases
- Evaluate the likelihood of entry, establishment or spread of these diseases, as well as the associated potential biological and economic consequences
- Evaluate the likelihood of entry, establishment or spread of these diseases according to the SPS measures that might be applied.

The SPS Agreement defines 'appropriate level of sanitary or phytosanitary protection' as the level of protection deemed appropriate by the member country establishing a sanitary or phytosanitary measure to protect human, animal or plant life or health within its territory. This is termed 'appropriate level of protection' (ALOP) in Australia. Further information on Australia's rights and obligations arising from the SPS Agreement may be found in the report "National Risk Management and the SPS Agreement."[6]

Office International des Epizooties

Australia is a member of the OIE and actively contributes to the development of

international animal health standards. The OIE publication relevant to this IRA is the OIE International Animal Health Code (the Code).[7] The Code provides guidance in relation to trade in terrestrial animals and birds, and their products and, in Section 1.4, outlines the requirements for an IRA. The Code also categorises and lists important animal or zoonotic diseases. Those pertinent to the importation of uncooked chicken meat are described under Hazard Identification.

CURRENT QUARANTINE POLICY ON UNCOOKED CHICKEN MEAT

International quarantine policy on uncooked chicken meat

The import of uncooked chicken meat into Australia is currently prohibited.

Domestic arrangements for uncooked chicken meat

As a general rule, chicken meat could move freely in trade between all States and Territories within Australia. At the time of writing, some restrictions do exist, due to outbreaks of virulent Newcastle disease (ND) in certain areas in NSW, since September of 1998. The following sets out the latest position in relation to this disease, as notified to OIE by the Australian Chief Veterinary Officer, on 22 December 2000.[8]

> There have been no further outbreaks of virulent ND since February 2000, when the last case of virulent ND and isolation of virulent ND virus occurred. The Commonwealth and State ministers of agriculture, meeting as the Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ), endorsed a national approach to managing Newcastle disease due to virulent virus of Australian origin. A government–industry National ND Management Committee has overseen a national survey for ND viruses and a national management plan. This plan involved targeted vaccination in two Designated Risk Areas (DRAs) in NSW, restrictions on movement of products, and implementation of agreed standard operating procedures (SOPs) for clean-up, disinfection and other routine operations. This was an industry-managed plan implemented in conjunction with governments, pending results of the national survey to determine if virulent ND virus or precursor viruses occurred outside the two DRAs. Birds on five multi-age layer farms in the DRAs and from which virulent ND virus was isolated previously (in late 1999 and early 2000) were vaccinated, quarantined and not depopulated, pending results of the national survey.
>
> The national survey was completed this month and showed no evidence of the presence of virulent ND virus or of related precursor viruses. After consideration of the results of the national survey, the National ND Management Committee endorsed a quality assurance approach to achieving OIE status as an ND-free country, based on the following essential elements:

industry adopting agreed quarantine, movement controls and surveillance measures by implementing SOPs;

completion of depopulation and clean-up of the remaining five premises from which virulent ND virus was isolated previously;

third party audit of the implementation of SOPs;

NSW Government gazetting the two DRAs to provide necessary legal underpinning;

other State and Territory Governments to implement verification checks on poultry and poultry products imported from NSW; and

the National ND Management Committee and its Technical Working Group continue to provide strategic policy and technical overview.

The National ND Management Committee defined two DRAs for the purposes of managing the ND situation in NSW. These two areas are the Cumberland and Tamworth areas. These areas have now been formally gazetted under NSW State legislation to provide legal underpinning to the agreed measures. Although the areas are now formally gazetted, within these areas, a number of establishments (e.g. elite flocks operating under high biosecurity) have remained free of any ND virus and can move birds and products to other areas (subject to the SOPs) and could export (subject to meeting SOPs and specific requirements of importing countries. The National ND Management Committee has also endorsed detailed SOPs and agreed that NSW government and NSW industry will manage the implementation of the SOPs. Depopulation and clean-up of the remaining five premises from which virulent ND virus was isolated previously (in late 1999 and early 2000) has commenced and is expected to be completed by the end of February 2001.

Australia hopes to regain national freedom from ND in accordance with the OIE requirements later in 2001. At this point, movement restrictions for control of this disease are expected to be eased.

POTENTIALLY AFFECTED AUSTRALIAN ANIMAL INDUSTRIES

The primary at-risk species is defined as the animal species to be imported, or the animal species from which the commodity to be imported is derived. The primary at-risk species for this IRA was therefore the domestic chicken. The chicken meat and egg industries were therefore considered to be the industries most directly affected. Secondary at-risk species were identified by noting the animal species that may be effected by each disease identified as a hazard (see Hazard Identification). The ostrich industry, pigeon fanciers and the avicultural community are also likely to be affected due to their reliance on secondary at risk species. For those diseases with zoonotic potential, humans were also considered secondary at risk species. In addition to these groups, native birds were also considered to be at risk, and the effects on the environment due to infection in native birds will be taken into account.

Pertinent characteristics of those industries associated with the primary and secondary target species are described below.

Animal production (chicken meat industry)

Industry Structure

The chicken meat industry is dominated by two large private companies which account for about 65% of chicken meat production and processing. The industry is distinguished by the fact that all growing/processing companies are effectively family-owned.

The chicken meat industry is located in NSW (37%), Victoria (28%), Queensland (16%), South Australia (9%), Western Australia (7%), Tasmania (2%) and NT / ACT (1%). Most chicken meat production (both growing and processing) is located relatively close to the centres of consumption. In addition to the main areas around the capital cities, there is substantial regional production near Tamworth, Griffith and Newcastle in NSW, Geelong and Bendigo in Victoria, and Murray Bridge in South Australia.

Contract Growing

Most chickens are grown under one of two systems – contract growing or company farms. Around 800 growers produce about 80% of total product under the contract system, which has been a feature of the industry for the past 30 years.
Characteristics of this system are:

- Processor control of inputs and rearing specifications: processors own chickens and feed, and supply contract growers with day old chicks to be reared according to detailed specifications.
- Rearing of chickens under contract: processors and contract growers enter into contracts, either on a batch to batch basis or on contractual terms of between one and five years. Growers are therefore independent contractors and not employees.
- Contract growers rear the chickens for 40-49 days and then the grown birds are picked up and transported to processing plants by the processors.
- Rearing fee is a small component of product costs; the cost of contract rearing contributes only 14.8% of the wholesale costs and 11% of the price to the end consumer.
- Significant equity contributions by contract growers; these growers contribute approximately 40% of the capital investment in the industry through ownership of farms, shedding and other facilities.

Contract growing is extremely capital intensive. Chicken growing sheds are highly specialised fixed assets and have virtually no alternative use. Thus, a reasonable

degree of stability and predictability in growing arrangements is required to ensure future investment.

(ii) Company Farms

Approximately 20% of birds are grown on farms owned and operated by processing companies.

Exports

Only 3% of chicken meat product is exported. Total chicken meat exports in 1998/99 were 18,900 tonnes valued at over $23 million.[9]

Major export markets are Hong Kong/China, and South Africa; with Pacific Island nations collectively making up the largest export market. These markets have been severely compromised by the 1998 and 2000 Newcastle disease outbreaks. Some countries have bans on NSW product only, but increasingly the bans are being extended to other States. However, the industry's goal is to regain its status of Newcastle disease freedom as soon as possible.

There is a growing export market for Australian breeding stock. Its potential growth, however, will depend on the continued absence of endemic and "imported" virulent diseases in Australia.

Imports

Imports of cooked chicken meat from New Zealand have been permitted for a number of years. Since August 1998 importation of cooked chicken meat from Denmark, Thailand and the USA has been permitted subject to stringent quarantine restrictions. However, to date no chicken meat has been imported under this protocol. Currently uncooked chicken meat may not be imported but Biosecurity Australia is conducting this non-routine IRA of potential imports from all countries.

Employment/Growth

Nationally, industry employment in the 1990's has been relatively stable, directly employing about 16,000 people overall comprising 5,000 on farms and 11,000 in the processing and support sector.

A major challenge facing the industry relates to community concerns regarding its environmental performance, particularly in relation to odour levels. Local governments, and State and Federal Ministers from time to time receive complaints from citizens living near to poultry farms. However, the day to day management of environmental concerns is a matter for the industry in conjunction with relevant State and local governments.

International Comparisons

The Australian chicken meat industry is small by comparison with those in other countries. For example the United States industry accounts for 151 million birds per week compared to the 8 million in Australia. The two largest producers in the United States are each larger than the combined Australian industry.

The USA and Thailand have a cost advantage over the Australian industry even though the Australian chicken meat industry is as technologically efficient as any other country and competitive with those in European Union (EU) countries which are heavily subsidised. In the last two years, Brazil has emerged as a lower cost producer than the USA and will play a growing role in international trade.

Global poultry meat imports increased 13% in 1999. Forecasts for 2000 are up another 4%. The US expects exports to increase during 2000 particularly to Asian markets. Exports to Russia recovered in late 1999, and as well, 74,000 tonnes of chicken meat were provided to Russia as food aid. Brazil continues to post record exports including product to Saudi Arabia, Hong Kong and Japan. Hong Kong as well as being a major importer of chicken products is also the second largest world exporter. Thailand's domestic market continues to grow, while Thai exports are facing strong competition from Brazil, USA and China. Thailand is shifting its export sales from raw to cooked products to Japan and the EU.[10]

Animal production (egg industry)

There are about 900 commercial egg producers in Australia. The industry is still undergoing rationalisation following extensive deregulation of egg marketing arrangement, which commenced in 1989, which has led to easier entry into the industry and an increase in farm size. An ongoing reduction in the number of producers in the industry will continue. Almost 45% of commercial egg production is undertaken by flocks owned by seven family run companies.[11]

Approximately 37% of egg production is located in NSW, 24% in Victoria, 18% in Queensland, 10% in Western Australia, 6% in South Australia, 2% each in Tasmania and the Australian Capital Terriorty (ACT), and 1% in the Northern Territory. The principal areas of industry concentration are on the outskirts of Sydney and Melbourne. Secondary areas of industry concentration are on the Darling Downs, near Tamworth and on the outskirts of Perth. Other areas of industry concentration are in the outskirts of Brisbane, the Hunter Valley, the Gawler/Murray Bridge area and near Young, Canberra, Bendigo and Geelong.

Overall, it is believed that 6-7% of households keep poultry.[12] It is estimated that

about 10% of all eggs are produced by small operators or backyard producers.

Egg production is a highly specialised, capital intensive industry with little opportunity for capital substitution. Capital in the form of sheds and grading floors has a long economic life. Despite its capital intensity it is estimated 3000 people are employed in the industry.

The commercial egg production industry is comprised of 3 components. These are:

- On-farm aspects which includes the breeding of layer stock, hatching, pullet rearing to point-of-lay, and layer farms;
- Grading, packing, sales and distribution; and
- Egg products manufacturing, sales and distribution.

These activities are often integrated. There is an increasing trend to integrate, especially as far as pullet rearing and egg production are concerned. There may also be integration back to feed milling. However, there is usually no integration with other sectors of agriculture, although a very small proportion of producers are involved in grain growing.

The individual producer or company rarely undertakes all components of the production and manufacture of egg and egg products. This is because breeding and hatching is dominated by four companies, two of which do not have interests in egg production.[11]

Most egg producers have their own eggs graded and packed in cartons under the name of an egg marketing organisation or in supermarket owned brands. Approximately 80% of all eggs are marketed under seven brands which tend to enjoy regional rather than national dominance.

Notwithstanding these facts, many producers have combined the growing, layer and egg grading operations and supply both wholesale and retail markets. Some producers and most backyard operations sell table eggs directly to the public.

Egg Products Manufacturing

Liquid, frozen and spray dried products are manufactured at processing plants. These products may be in whole or separated form. Small volumes of specialised egg products are also manufactured. There are five major plants in Australia located at Newcastle, Melbourne, Perth, Adelaide and Griffith.

Monetary production data (chicken meat industry)

Australian poultry meat production was 604,000 tonnes in 1998/99 with a gross value of $1,174 million (chicken meat accounts for almost 90% of this). The Australian Bureau of Agriculture and Resource Economics (ABARE) estimate for 2000/01 is an increase to 647,000 tonnes.

Domestic retail sales of chicken meat are estimated at $2.5 billion per annum. Per person chicken meat consumption is projected to rise to around 33 kilograms by 2004/05, up 7% from that in 1998-99.

Monetary production data (egg industry)

The Australian Bureau of Statistics (ABS) has estimated the gross value of production of the Australian egg industry at $344.7 million in 1998/1999. Domestic retail sales of shell eggs are estimated at $525 million. The value of exports (shell egg and egg products) is valued at slightly under $2 million.[13] This figure would double if exports of eggs for breeding and hatching purposes were included.

Characteristics of domestic trade (chicken meat industry)

The chicken meat industry produces a range of fresh, frozen and cooked products. Raw products in the form of fresh and frozen whole birds account for 44% of the market. Raw value added products in the form of cut up chickens – breasts, legs, thighs and other specialty lines are produced both bone-in (21%) and de-boned (19%) for a total market share of 40%. Other value-added products include ready to cook and fully cooked products and represent 16% of the market.

The industry supplies its products to four market segments:

- supermarkets 40%
- take away outlets 28%
- food service industry 18%
- all others 14%.

The food service industry includes restaurants, hotels, caterers, hospitals, armed services, canteens and similar type operations. The ‘all other’ category includes butcher shops, specialty chicken shops, milk bars and other small retail outlets.

Characteristics of domestic trade (egg industry)

There is a trend away from the sale of eggs in shell through retail outlets towards the processed food and food service sectors. There is also a trend to increased egg products manufacturing. AEIA estimates 68% of eggs are sold in shell form through retail outlets, 15% are sold to the processed food/food service sector and 17% are

transformed into manufactured egg products, principally for the processed food sector. Between 350 and 400 tonnes of dried egg products are imported annually at an estimated value of $3.5 to $4 million.[13] Within the egg products manufacturing sector, there is also a trend towards dried egg products and away from liquid egg products.

Characteristics of international trade (chicken meat industry)

Only approximately 10% of world poultry production enters the export trade, with the majority of chicken meat being consumed in the country of origin.[14] However, forecasts of world poultry production, and exports of poultry product, are optimistic, and significant growth in the poultry industry worldwide is predicted in the medium term.[14]

Five major producing countries, being the USA, Brazil, the EU, China and Thailand, dominate world trade in poultry meat. The USA is by far the largest exporter, with exports of 2,389,000 tonnes in 1999. In world terms, Australia is a very small exporter, with exports of approximately 19,000 tonnes in 1999.[14] Total poultry meat exports in 1999 were[10] as shown in Table 1.

Table 1: Poultry meat exports 1999.

Country	'000t
World	5,987
USA	2,500
European Union	830
Brazil	794
Hong Kong	784
China	390
Thailand	278

Characteristics of international trade (egg industry)

A relatively small proportion of shell eggs and egg products is also exported. However, trends towards freer trade and the use of egg products at the expense of shell eggs should mean underlying growth in the egg products trade. According to the United States Department of Agriculture, preliminary figures for 1999 suggest the largest exporter is the USA, followed by The Netherlands, China, Canada and France. (These figures exclude trade within the EU and hatching eggs). The US was forecast to export approximately 220 million dozen eggs in shell and product form in 1999,

compared to approximately 2 million dozen from Australia.

Other potentially affected industries.

Ostrich industry

While relatively small compared with the chicken meat and egg industries, the Australian ostrich industry has grown in recent years and significant export markets have been developed for ostrich meat. Recent outbreaks of Newcastle disease in NSW have led to restrictions on access to export markets for producers in affected parts of the State.

Pigeon fanciers

While it is not a large or well-organised industry in Australia, there are a number of individuals who have put considerable resources into developing international markets for racing and show pigeons. Avian diseases introduced via imported chicken meat can also be expected to have an adverse effect on these markets. Restrictions on exports from NSW due to outbreaks of Newcastle disease in that State have already caused financial losses to some pigeon breeders.

Avicultural community

The aviculture community in Australia covers a wide spectrum of the population, from individuals with a single pet bird, to commercial enterprises worth millions of dollars. A recent ABS report on pet ownership in Australia reported that 3 out of 5 households in Australia have one or more birds as pets. The Avicultural Federation of Australia, the peak body for the aviculture community, claims to represent 10,000 bird keepers.

Native birds and the environment.

The economic value of native birds is difficult to measure. However, Biosecurity Australia has a responsibility towards the protection of wildlife and the environment. Australia has significant populations of native birds, many of which occur naturally in no other part of the world. In addition, some of these native species have been shown by overseas experience to be susceptible to the major exotic diseases. The potential effects of an outbreak of exotic disease in our wild bird populations are difficult to estimate.

Despite the difficulty of quantifying the value of native populations of birds, the conservation value is extremely high. Possible effects of exotic disease introduction on native populations and the environment are serious, and must be given adequate consideration in the risk analysis process.

METHOD FOR HAZARD IDENTIFICATION

Hazard identification is defined in the OIE International Animal Health Code as *the process of identifying the pathogenic agents that could potentially be introduced in the commodity considered for importation*. Hazard identification is considered a classification step, identifying pathogenic agents as potential hazards or not.

In this IRA, hazard identification was initiated by generating a list of potential pathogenic agents, or 'potential hazards'. These were the pathogenic agents associated with each of the OIE List A and B diseases, and those of other diseases considered relevant to the importation of uncooked chicken meat.

The initial list of potential hazards was refined by applying the inclusion/exclusion criteria shown below (a procedure termed *hazard refinement*).

- The pathogenic agent infects the domestic chicken[1]
- The pathogenic agent could be introduced in uncooked chicken meat.
- The pathogenic agent (or a clearly identified strain of the pathogenic agent) could produce adverse consequences in susceptible humans or animal species in Australia
- The pathogenic agent may be present in exporting countries
- The pathogenic agent (or a clearly identified strain of the pathogenic agent) should not be present in Australia. If present, the pathogenic agent is associated with a notifiable disease, or is subject to an official control or eradication program

IDENTIFICATION OF POTENTIAL HAZARDS

The list of potential hazards outlined below was compiled from the OIE List A and B, and a list of the causative agents for other diseases considered of importance to the husbandry of chickens and the importation of uncooked chicken meat.

OIE List A diseases

1. Highly pathogenic avian influenza (HPAI)
2. Newcastle disease (ND)

[1] This criterion includes agents that are pathogenic for the species concerned, or that may be carried or transmitted by the species concerned

OIE List B diseases

3. Avian infectious bronchitis (IB)
4. Avian infectious laryngotracheitis (ILT)
5. Avian tuberculosis
6. Duck virus hepatitis (DVH)
7. Duck virus enteritis (DVE)
8. Fowl cholera
9. Fowl pox
10. Fowl typhoid
11. Infectious bursal disease (IBD)
12. Marek's disease (MD)
13. Avian mycoplasmosis (*Mycoplasma gallisepticum*)
14. Avian Chlamydophilosis (formerly chlamydiosis)
15. Pullorum disease (*Salmonella* Pullorum)

FAO List C diseases

16. Infectious coryza
17. Avian encephalomyelitis
18. Avian spirochaetosis
19. *Salmonella* Enteritidis infection
20. *Salmonella* Typhimurium infection
21. Avian leucosis-sarcoma complex

Other diseases/disease agents

22. Angara disease (AAV type 1)
23. Quail bronchitis (AAV type 1)
24. Avian adenovirus splenomegaly disease (AAS) (AAV type 2)
25. Egg drop syndrome (AAV type 3)
26. Avian nephritis
27. Campylobacteriosis
28. Chicken infectious anaemia (Chicken anaemia agent (CAA) infection)

29. Derszy's disease
30. Entero-haemorrhagic *Escherichia coli* infections (EHECs)
31. Japanese encephalitis (JE)
32. Muscovy duck virus infection
33. Mycoplasmosis (*M. Meleagridis*)
34. Mycoplasmosis (*M. iowae*)
35. Mycoplasmosis (*M. synoviae*)
36. Ornithobacteriosis
37. *Riemerella anatipestifer* infection
38. Reovirus infection
39. Reticuloendotheliosis
40. Transmissible viral proventriculitis
41. Turkey coronavirus enteritis
42. Turkey rhinotracheitis (TRT)
43. Eastern equine encephalomyelitis/Western equine encephalomyelitis/Venezuelan equine encephalomyelitis (EEE/WEE/VEE)
44. West Nile virus (WNV) infection

HAZARD REFINEMENT

Brief discussions substantiating decisions to retain or reject pathogenic agents as 'hazards' to be further considered in the IRA, are provided in the following section.

Table 2: Hazard refinement - a categorisation step

	Disease	Hazard identification criteria (Yes/No)				Retain for risk assessment (Yes/No)
		Agent infects domestic chicken	Potential for transmission in chicken meat via uncooked chicken meat[1]	Capable of adverse consequences[2]	Occurrence in Australia[3]	
	OIE List A diseases					
1.	Highly pathogenic avian influenza	YES	YES	YES	NO	YES
2.	Newcastle disease	YES	YES	YES	YES[4]	YES
	OIE List B diseases					
3.	Avian infectious bronchitis	YES	NO	YES	YES	NO
4.	Avian infectious laryngotracheitis	YES	YES	YES	YES	NO
5.	Avian tuberculosis	YES	YES	YES	YES	NO
6.	Duck virus hepatitis	NO	NO	YES	NO	NO
7.	Duck virus enteritis	NO	NO	YES	NO	NO

	Disease	Hazard identification criteria (Yes/No)				Retain for risk assessment (Yes/No)
		Agent infects domestic chicken	Potential for transmission in chicken meat via uncooked chicken meat[1]	Capable of adverse consequences[2]	Occurrence in Australia[3]	
8.	Fowl cholera	YES	YES	YES	YES	NO
9.	Fowl pox	YES	NO	YES	YES	NO
10.	Fowl typhoid	YES	YES	YES	NO	YES
11.	Infectious bursal disease	YES	YES	YES	YES[5]	YES
12.	Marek's disease	YES	NO	YES	YES	NO
13.	Avian mycoplasmosis (*Mycoplasma gallisepticum*)	YES	NO	YES	YES	NO
14.	Avian Chlamydophilosis	YES	NO	YES	YES	NO
15.	Pullorum disease	YES	YES	YES	NO[6]	YES
	FAO List C diseases					
16.	Infectious coryza	YES	NO	YES	YES	NO
17.	Avian encephalomyelitis	YES	YES	YES	YES	NO

	Disease	Hazard identification criteria (Yes/No)				Retain for risk assessment (Yes/No)
		Agent infects domestic chicken	Potential for transmission in chicken meat via uncooked chicken meat[1]	Capable of adverse consequences[2]	Occurrence in Australia[3]	
18.	Avian spirochaetosis	YES	NO	YES	YES	NO
19.	*Salmonella* Enteritidis	YES	YES	YES	NO	YES
20.	*Salmonella* Typhimurium	YES	YES	YES	NO[7]	YES
21.	Avian leucosis-sarcoma complex	YES	NO	YES	YES	NO
	Other diseases of concern					
22.	Avian adenovirus type 1 - Angara disease	YES	YES	YES	NO	YES
23.	Avian adenovirus type 1 - Quail bronchitis	YES	YES	YES	NO	YES
24.	Avian adenovirus type 2 – Avian adenovirus splenomegaly disease	YES	YES	YES	YES	NO
25.	Avian adenovirus type 3 – Egg drop syndrome	YES	YES	YES	YES	NO
26.	Avian nephritis	YES	YES	YES	YES	NO

	Disease	Hazard identification criteria (Yes/No)				Retain for risk assessment (Yes/No)
		Agent infects domestic chicken	Potential for transmission in chicken meat via uncooked chicken meat[1]	Capable of adverse consequences[2]	Occurrence in Australia[3]	
27.	Campylobacteriosis	YES	YES	YES	YES[5]	YES
28.	Chicken anaemia agent	YES	YES	YES	YES	NO
29.	Derszy's disease	NO	NO	YES	NO	NO
30.	Entero-haemorrhagic *Escherichia coli* (EHEC) infections	YES	YES	YES	YES[5]	YES
31.	Japanese encephalitis	YES	NO	YES	YES[8]	NO
32.	Muscovy duck virus	NO	NO	YES	NO	NO
33.	Mycoplasmosis (*M. meleagridis*)	NO	NO	YES	YES	NO
34.	Mycoplasmosis (*M. iowae*)	YES	NO	YES	NO	NO
35.	Mycoplasmosis (*M. synoviae*)	YES	NO	YES	YES	NO
36.	Ornithobacteriosis	YES	YES	YES	NO	YES
37.	*Riemerella anatipestifer* infection	YES	NO	YES	YES[5]	NO

	Disease	Hazard identification criteria (Yes/No)				Retain for risk assessment (Yes/No)
		Agent infects domestic chicken	Potential for transmission in chicken meat via uncooked chicken meat[1]	Capable of adverse consequences[2]	Occurrence in Australia[3]	
38.	Reovirus infection	YES	YES	YES	YES	NO
39.	Reticuloendotheliosis	YES	NO	YES	YES	NO
40.	Transmissible viral proventriculitis	YES	YES	YES	YES	NO
41.	Turkey coronavirus enteritis	NO	NO	YES	YES	NO
42.	Turkey rhinotracheitis	YES	YES	YES	NO	YES
43.	EEE/VEE/WEE	YES	NO	YES	NO	NO
44.	West Nile virus	YES	NO	YES	NO	NO

Legend:

1. *Potential for transmission in chicken meat via uncooked chicken meat*: Uncooked chicken meat could potentially serve to transmit the pathogen to susceptible Australian animals.
2. *Capable of adverse impact*: The pathogenic agent (or a clearly identified strain of the pathogenic agent) could potentially produce adverse consequences in susceptible humans or animal/bird species in the importing country
3. *Occurrence in Australia:* The pathogenic agent (or a clearly identified strain of the pathogenic agent) should not be present in the importing country. If present, the

pathogenic agent is associated with a notifiable disease, or is subject to an official control or eradication program

4. Virulent Newcastle disease virus of Australian origin occurs in Australia, but Australia remains committed to eventual eradication, and controls are in place to prevent further spread of the disease. Exotic serotypes of NDV are considered to be of quarantine concern.
5. Although the disease occurs in Australia, more pathogenic serotypes are known to exist overseas, which have not been reported in Australia.
6. Australian commercial poultry are considered to be free of *S.* Pullorum, although OIE records that there is serological evidence of the agent in Australia.
7. *S* Typhimurium occurs commonly in Australia, but multi-drug resistant strains have not been reported in Australia except in returning travellers.
8. One human case of JE acquired in Australia has been reported, and there has been serological evidence of infection in sentinel animals on the Cape York Peninsula.

SUBSTANTIATION OF TABLE 1

1 Highly pathogenic avian influenza

Agent infects domestic chicken

Highly pathogenic avian influenza (HPAI), also known as fowl plague, has been recognised as a highly lethal generalised viral disease of poultry since 1901.[15]

Potential for transmission in chicken meat

HPAI virus is present in the muscle, oviduct, intestine, pancreas, liver, spleen, kidney and lungs, of infected chickens. Becker and Uys[16] reported the isolation of the virus from the muscle of experimental chickens up to six days post inoculation.

Potential for adverse consequences

HPAI is an OIE List A disease. Therefore, by definition, it is a "communicable disease which have the potential for very serious and rapid spread, irrespective of national borders, which is of serious socio-economic or public health consequence and which is of major importance in the international trade of livestock and livestock products". [7]

Occurrence in Australia

There have been outbreaks of HPAI in Australia in 1976, 1985, 1992, 1994[15] and 1997. These outbreaks were eradicated by stamping out.

2 Newcastle disease

Agent infects domestic chicken

Newcastle disease (ND) is a highly infectious and contagious viral disease of poultry and wild birds caused by a paramyxovirus (type 1).[15]

Potential for transmission in chicken meat

NDV can be present in chicken meat derived from infected birds showing no clinical signs of infection or from vaccinated birds that carry the virulent virus and may act as carriers.[17] An outbreak in Australia in 1930 is believed to have resulted from the swill feeding of ship's garbage containing viscera of infected birds.[15] Grausgruber [18] reports a number of outbreaks of disease arising from the feeding of offals from poultry to backyard birds, and one outbreak apparently due to contact of backyard poultry with melt water from frozen carcases. Alexander[19] quotes Gordon *et al*[20] as stating that, in 1947, one third of the first 542 outbreaks of Newcastle disease in England and Wales were considered to be directly attributable to feeding poultry waste to chickens. He also quotes work by Reid,[21] who showed that NDV was able to be isolated from 66%

of batches of frozen poultry imported into Great Briton in that year. However, Alexander concludes with the statement "Modern methods of poultry carcass preparation and legislation on the feeding of untreated swill to poultry have greatly diminished the risk from poultry products, but the possibility of spread in this way nevertheless remains."[19]

Potential for adverse consequences

Newcastle disease is an OIE List A disease. Therefore, by definition, it is a "communicable disease which has the potential for very serious and rapid spread, irrespective of national borders, which is of serious socio-economic or public health consequence and which is of major importance in the international trade of livestock and livestock products".[7] In addition to the obvious risks to the poultry industry and international trade in poultry products, there are a number of wild feral and native species which are susceptible to Newcastle disease virus.[22] Should these birds become infected as a result of the importation of infected chicken meat, they have the potential to seriously affect Australian native bird populations.[23]

Occurrence in Australia

There were 2 outbreaks of velogenic ND in Australia in 1930, and in 1932. These outbreaks were concentrated in the suburbs of Melbourne.[15] After the absence of velogenic ND for more than 60 years, there have been a number of outbreaks of ND in and around Sydney between 1998 and 2000.

A national survey aimed at identifying the distribution of Newcastle disease viruses in Australia was completed in December 2000, and showed no evidence of the presence of virulent ND virus or of related precursor viruses. After consideration of the results of the national survey, the National ND Management Committee endorsed a quality assurance approach to achieving OIE status as an ND-free country, based on the following essential elements:

- industry adopting agreed quarantine, movement controls and surveillance measures by implementing Standard Operating Procedures (SOPs);
- completion of depopulation and clean-up of the remaining five premises from which virulent ND virus was isolated previously;
- third party audit of the implementation of SOPs;
- NSW Government gazetting the two Designated Risk Areas (DRAs) to provide necessary legal underpinning;
- other State and Territory Governments to implement verification checks on poultry and poultry products imported from NSW; and
- the National ND Management Committee and its Technical Working Group continue to provide strategic policy and technical overview.

Australia remains committed to a stamping-out program response to any incursion of virulent ND of exotic origin.

3 Avian infectious bronchitis

Agent infects domestic chicken

Infectious bronchitis (IB) is an acute, highly contagious viral respiratory disease of chickens. The disease is generally regarded as being restricted to chickens, but the virus has also been isolated from pheasants with respiratory signs and depression of egg production.[24]

Potential for transmission in chicken meat

Infected chickens have serous, catarrhal, or caseous exudate in the trachea, nasal passages, and sinuses. Air sacs may appear cloudy or contain caseous exudate. There may be small areas of pneumonia. Some nephrotoxic infections produce swollen pale kidneys.[24] Visceral lesions occur. Presence of the organism in carcases derived from infected chickens is therefore possible, and introduction of the organism could occur. However, the usual mode of transmission is by inhalation.[25] It is considered that chicken meat does not pose a risk of transmission of the virus to susceptible Australia birds.

Potential for adverse consequences

Infectious bronchitis is an OIE List B disease, and therefore by definition is a "communicable disease which is considered to be of socio-economic and/or public health importance within countries and which is significant in the international trade of livestock and livestock products". [7] The disease causes poor weight gain and feed conversion efficiency, and produces lesions which can result in condemnations at processing of broilers. It also can lead to declines in egg production and egg quality. [24]

Occurrence in Australia

Avian infectious bronchitis occurs throughout the world and is prevalent in all poultry-raising areas of Australia.[25] It is controlled by vaccination. [26]

4 Avian infectious laryngotracheitis

Agent infects domestic chicken

Infectious laryngotracheitis is a viral respiratory tract infection of chickens. The virus has also been isolated from the trachea of a peafowl, and the upper respiratory tract of young turkeys.[27] Experimental infection of ducks has produced subclinical disease and seroconversion.[27]

Potential for transmission in chicken meat

Gross lesions may be found in the conjunctiva and throughout the respiratory tract of ILTV infected chickens, but are most common in the larynx and trachea.[27] Contamination of the carcase of chickens slaughtered while infected with ILTV is therefore possible. Infection normally takes place by inhalation, but has also been established by ingestion, and mechanical transmission via fomites has been demonstrated.[28] Transmission via chicken meat is therefore possible.

Potential for adverse consequences

Infectious laryngotracheitis is an OIE List B disease, and therefore by definition is a "communicable disease which is considered to be of socio-economic and/or public health importance within countries and which is significant in the international trade of livestock and livestock products".[7] Severe epizootic forms of the disease cause high morbisity (90-100%) and variable mortality ranging from 5-70%. Mild enzootic forms such as have been described in Australia have morbidity as low as 5% and very low mortality (0.1-2%)[27]

Occurrence in Australia

Infectious laryngotracheitis occurs in all poultry-raising areas of Australia.[26,28] It is a notifiable disease and is controlled by vaccination.[26]

5 Avian tuberculosis

Agent infects domestic chicken

Avian tuberculosis due to *M avium* affects poultry and a wide range of other birds. It is of particular significance in captive exotic birds.[29]

Potential for transmission in chicken meat

Lesions are seen most frequently in the liver, spleen, intestines and bone marrow. However, the bacteraemia provides for a generalised distribution of lesions.[29] The widespread nature of the lesions means that contamination of the carcase of slaughtered chickens is possible. The bacteria are persistent in the environment and have been demonstrated to survive for long periods in carcases of infected chickens.

Potential for adverse consequences

Avian mycobacteriosis is an OIE List B disease, and therefore by definition is a "communicable disease which is considered to be of socio-economic and/or public health importance within countries and which is significant in the international trade of livestock and livestock products".[7] Avian mycobacteriosis causes a variety of disease syndromes in birds, up to and including sudden death without prior clinical signs.[30] Further, there is a significant risk of disease in humans, particularly those with concurrent immunosuppressive disease.

Occurrence in Australia

Avian tuberculosis occurs in Australia.[31] It is a notifiable disease, with controls at the border, and controls on movement within the country.[26]

6 Duck virus hepatitis (DVH)

Agent infects domestic chicken

Duck virus hepatitis is a highly fatal rapidly spreading viral infection of young ducks caused by any of three different viruses. The viruses are DHV types 1, 2 and 3. Ducks are considered to be the only natural hosts of duck virus hepatitis.[32]
DHV type 1 occurs only in young ducklings in natural outbreaks, but under experimental conditions poults have developed clinical signs , lesions, and neutralizing antibody following exposure.[32] Experimental infections have also been reported in goslings, and mallard ducklings.[32] DVH type 2 appears to infect only ducks.[32] Ducklings appear to be the only animals susceptible to DHV type 3.[32]

Potential for transmission in chicken meat

Since the disease does not occur in chickens, and chickens have not been shown to be subclinically infected, the disease is not likely to be transmitted in uncooked chicken meat.

Potential for adverse consequences

Duck virus hepatitis is an OIE List B disease, and therefore by definition is a "communicable disease which is considered to be of socio-economic and/or public health importance within countries and which is significant in the international trade of livestock and livestock products".[7]

Occurrence in Australia.

Duck virus hepatitis does not occur in Australia. It is a notifiable disease and quarantine precautions are taken at the border.[26]

7 Duck virus enteritits (Duck plague)

Agent infects domestic chicken

The disease appears to be restricted in nature to domestic and wild ducks, geese and swans.[15,33]

Potential for transmission in chicken meat

Since the disease does not occur in chickens, and chickens have not been shown to be subclinically infected, the disease is not likely to be transmitted in uncooked chicken meat.

Potential for adverse consequences

Duck virus enteritis is an OIE List B disease, and therefore by definition is a

"communicable disease which is considered to be of socio-economic and/or public health importance within countries and which is significant in the international trade of livestock and livestock products".[7]

Occurrence in Australia

Duck virus enteritis does not occur in Australia. It is a notifiable disease and quarantine precautions are taken at the border.[26]

8 Fowl cholera

Agent infects domestic chicken

Fowl cholera is a contagious disease affecting domesticated and wild birds, which is caused by *Pasteurella multocida*. Most reported outbreaks occur in chickens, turkeys, ducks and geese. The disease also affects other types of poultry and game birds raised in captivity, zoo birds, and wild birds.[34]

Potential for transmission in chicken meat

Organisms are disseminated throughout the carcases of birds that die of acute fowl cholera, and these carcases have been shown to be a source of further infection.[34] Uncooked chicken meat must therefore be considered as a possible vector for the disease.

Potential for adverse consequences

Fowl cholera is an OIE List B disease, and therefore by definition is a "communicable disease which is considered to be of socio-economic and/or public health importance within countries and which is significant in the international trade of livestock and livestock products".[7]

Occurrence in Australia

Fowl cholera occurs in Australia, and is controlled by vaccination,[35] and by sanitation, isolation and antibiotic therapy.[26]

9 Fowl pox

Agent infects domestic chicken

Pox is a common viral infection of domestic birds including chickens, turkeys, pigeons and canaries. It has also been reported from more than 60 species of birds in 20 families. Fowl pox virus is the reference virus for the avipox genus.[36]

Potential for transmission in chicken meat

The disease may occur in one of two forms, either cutaneous or diphtheritic. In the cutaneous form, the disease is characterised by lesions on the comb, wattle, eyelids, and non-feathered areas of the body. In the diphtheritic form, lesions occur on the mucous membrane of the mouth, oesophagus, or trachea with accompanying coryza-

like mild or severe respiratory signs when lesions involve the trachea.[36] Transmission occurs via mechanical contact of the virus with injured or lacerated skin. Insects such as mosquitos may also act as mechanical vectors.[36] It is therefore considered that chicken meat would not serve to transmit the virus to susceptible Australian birds.

Potential for adverse consequences

Fowl pox is an OIE List B disease, and therefore by definition is a "communicable disease which is considered to be of socio-economic and/or public health importance within countries and which is significant in the international trade of livestock and livestock products". [7] Flock mortality is generally low, in the mild cutaneous form of the disease. In the diphtheritic form, or when the disease is complicated by other infectious agents, or by poor environmental conditions, the mortality may be high.[36]

Occurrence in Australia

Fowl pox occurs world wide and is widespread in Australia, requiring regular vaccination for control.[26,37]

10 Fowl typhoid (*Salmonella* Gallinarum)

Agent infects domestic chicken

Fowl typhoid is an acute or chronic infection primarily of chickens and turkeys[38] caused by infection with *Salmonella enterica* serovar Gallinarum (*S* Gallinarum). Many other species of poultry including ducks, guinea fowl, quail, grouse, and pheasants are susceptible to infection.

Potential for transmission in chicken meat

Birds of any age may be infected with the bacteria but may not show macroscopic lesions. Acute fowl typhoid is characterised by systemic infection and *S* Gallinarum can be isolated from most body tissues including tendon sheaths and joints such as the hock or wing. In chronically affected birds these organisms may be isolated from reproductive tissue, the peritoneum, various internal organs including the intestines, synovial fluid and the interior of the eye [39]. Infected chicken meat may therefore serve to introduce the agent into Australia. Infection in older birds is spread by the faecal/oral route, or by cannibalism of active cases or carriers.[40] It is therefore possible that infected chicken meat could transmit the disease to susceptible Australian birds.

Potential for adverse consequences

Fowl typhoid is an OIE List B disease, and therefore by definition is a "communicable disease which is considered to be of socio-economic and/or public health importance within countries and which is significant in the international trade of livestock and livestock products".[7]

Occurrence in Australia

Fowl typhoid has a worldwide distribution, but has been diagnosed in Australia only in Victoria and Tasmania - in turkeys in Victoria and in both fowls and turkeys in Tasmania. The disease was last seen in Tasmania in 1940. The Victorian outbreak was in 1952. The disease has not been reported in Australia since 1952.[26,40]

11 Infectious bursal disease

Agent infects domestic chicken

Infectious bursal disease (IBD) is an non-enveloped, bisegmented double stranded RNA virus belonging to the family Birnaviridae.[41] IBD viruses are divided into two serotypes, 1 and 2. Both serotypes infect chickens, but disease occurs only in chickens infected with serotype1.

Potential for transmission in chicken meat

Experimental trials undertaken at the Central Veterinary Laboratory, Weybridge, UK demonstrated that IBDV could be found in chicken muscle between 48-96 hours post infection.[42] Chickens are most susceptible between 3 and 6 weeks of age, corresponding to the period of maximal bursal development, during which period acute clinical signs may be seen. However, clinical cases may be observed up to 15-20 weeks of age. Infection in chickens younger than 3 weeks of age are generally sub-clinical and immunosuppressive.[43]

Potential for adverse consequences

IBD is an OIE List B disease, and therefore by definition is a “communicable disease which is considered to be of socio-economic and/or public health importance within countries and which is significant in the international trade of livestock and livestock products”.[7]

Occurrence in Australia

IBDV does occur in Australia. However, Australia and New Zealand are among the very few countries free of very virulent IBDV, which is prevalent in most countries of the world. It was first reported in the Netherlands [44] and Belgium in 1987 [45] and by 1990 the disease had spread throughout Europe, Africa, Middle Eastern countries and South East Asian countries. There are virulent variant strains, significantly more virulent than those found in Australia, in the United States.

12 Marek’s disease

Agent infects domestic chicken

MD is an infectious lymphoproliferative disease. Three forms of the disease are recognised: classical, acute and transient paralysis.[46] The classical form is characterised by peripheral nerve enlargement, paralysis and multiple, diffuse

lymphomatous tumours in visceral organs. In the acute form, extensive paralysis and rapid death may occur. Mortality and morbidity rates and speed of onset of clinical symptoms distinguish the classical and acute forms of MD. The third form of MD is transient paralysis, which manifests as viral encephalitis. A very virulent form of MD that produces gross lesions in the gonads and kidney with little or no involvement of nerve tissues occurs in Australia. Marek's disease is reported almost exclusively from domestic chickens but has been recorded in quail and turkeys.[46] Suggestive lesions have been reported in Great Horned Owl, ducks, a kestrel and swans.[47]

Potential for transmission in chicken meat

The majority of lesions occur in the peripheral nervous tissue, but lesions have also been reported, *inter alia*, from the skin and skeletal muscle.[48] Natural transmission of the virus occurs by direct or indirect contact between infected and susceptible birds. Experimentally, transmission is most consistently effected by inoculation of blood, tumour suspensions or cell free virus into day old chicks.[48] Chicken meat is considered not to be a likely source of transmission of the disease to susceptible birds.

Potential for adverse consequences

MD is an OIE List B disease, and therefore by definition is a "communicable disease which is considered to be of socio-economic and/or public health importance within countries and which is significant in the international trade of livestock and livestock products".[7] Direct and indirect losses arising from mortality and condemnation of carcases, decreased egg production, and cost of vaccine and application, due to Marek's disease have been assessed by Purchase as US$169M in the USA and US$943M world wide.[49]

Occurrence in Australia

Marek's disease has a universal distribution and most chickens become infected.[50] The disease occurs in Australia, and is controlled by vaccination.[26]

13 Avian mycoplasmosis (*M. gallisepticum*)

Agent infects domestic chicken

Mycoplasma gallisepticum infection occurs commonly as chronic respiratory disease in chickens, and as infectious sinusitis of turkeys. It has also been isolated from naturally occurring infections in pheasants, chukar partridge, peafowl, bobwhite and Japanese quail, ducks and geese.[51]

Potential for transmission in chicken meat

Typical gross lesions consist of catarrhal exudate in nasal and paranasal passages, trachea, bronchi, and air sacs. In severe cases there is fibrinous or fibrinopurulent perihepatitis and pericarditis, along with massive air sacculitis.[51] Contamination of the carcase of infected poultry cannot be ruled out. However, transmission of disease

appears to be by direct contact with susceptible birds, or by contaminated airborne dust, droplets or feathers.[51] It is considered unlikely that chicken meat would have the potential to transmit the disease.

Potential for adverse consequences

Mycoplasmosis is an OIE List B disease, and therefore by definition is a "communicable disease which is considered to be of socio-economic and/or public health importance within countries and which is significant in the international trade of livestock and livestock products".[7] Losses are associated with condemnations as a result of air sacculitis in chickens, and air sacculitis and sinusitis in turkeys, reduced feed and egg production efficiency, and increased medication costs.[51]

Occurrence in Australia

Mycoplasmosis due to *M. gallisepticum* occurs commonly in Australia,[26,52] and is controlled by vaccination[26] and eradication in breeder flocks.

14 Avian Chlamydophilosis (formerly chlamydiosis)

Agent infects domestic chicken

Avian chlamydophilosis is caused by *Chlamydophila psittaci*.[53] The disease occurs in a wide range of domestic and wild birds. Chickens, turkeys, psittacine birds, sea gulls, ducks, herons, egrets, pigeons, blackbirds, grackles, and house sparrows have all been shown to be infected.[54]

Potential for transmission in chicken meat

In experimental infections, high numbers of chlamydia have been found in abdominal air sacs and mesentery, lungs, thoracic air sacs, blood, spleen, kidney, and heart. Contamination of the carcase and offals is therefore possible.[54] However, *Chlamydophila psittaci* is an obligate intracellular parasite which depends on the host cell for energy by means of ATP and NADP.[53] Chicken meat is therefore not considered to pose a risk of transmission of chlamydyophila to susceptible Australian animals.

Potential for adverse consequences

Avian chlamydophilosis is an OIE List B disease, and therefore by definition is a "communicable disease which is considered to be of socio-economic and/or public health importance within countries and which is significant in the international trade of livestock and livestock products".[7] Human infections can occur, and are occasionally fatal.[54]

Occurrence in Australia

Chlamydophila (formerly known as *Chlamydia*) are enzootic in many species of wild birds in Australia. Infection is also common in homing pigeons and in man.

Although less common in poultry, the disease has been reported in commercial ducks[55,56] in broilers,[57] and in layer chickens.[58]

15 Pullorum disease (*Salmonella* Pullorum)

Agent infects domestic chicken

Pullorum disease is a septicaemia affecting primarily chickens and turkeys, but also other birds including quail, pheasants, ducks, peacocks and guinea fowl.[39]

Potential for transmission in chicken meat

Similar lesions occur to those described above for fowl typhoid, and therefore a similar risk of contamination of poultry meat exists.[59]

Potential for adverse consequences

Pullorum disease is an OIE List B disease, and therefore by definition is a "communicable disease which is considered to be of socio-economic and/or public health importance within countries and which is significant in the international trade of livestock and livestock products".[7]

Occurrence in Australia

OIE records that there is serological evidence or isolation of the causal agent, but no clinical signs of disease.[26] There is no evidence of the disease in commercial poultry. The Australian Salmonella Reference Laboratory did not record isolation of *S.* Pullorum from any Australian source in the last 10 years.[60]

16 Infectious coryza

Agent infects domestic chicken

Infectious coryza is an acute infectious disease of chickens caused by *Haemophilus paragallinarum*.[61]

Potential for transmission in chicken meat

Outbreaks in broiler chickens have resulted in condemnations of carcases due to air sacculitis. This indicates that the importation of carcases from infected chickens may lead to the introduction of the virus.[61] However, infection appears to be spread by direct respiratory transmission or by contact with contaminated drinking water only.[62]

Potential for adverse consequences

The disease causes economic loss due to poor growth performance in growing birds and marked reduction (10-40%) in egg production in layers. [61]

Occurrence in Australia

Infectious coryza is of worldwide distribution. It is present in Australia.[63] A vaccine is available.

17 Avian encephalomyelitis

Agent infects domestic chicken

Avian encephalomyelitis is an infectious viral disease affecting young chickens, pheasants, quail and turkeys.[64] Experimental infections have been documented in ducks, pigeons and guinea fowl.[65]

Potential for transmission in chicken meat

Gross lesions are found in the muscularis layer of the ventriculus. Histopathological changes are found in the CNS, (including the spinal cord) and in some viscera.[64] Virus is shed in the faeces and is quite resistant to environmental conditions. This indicates that carcases from infected birds could be infected or contaminated with the virus. Under natural conditions, ingestion is the usual portal of entry.[64] Therefore, imported chicken meat could potentially transmit the disease to Australian birds.

Potential for adverse consequences

Calnek *et al*[64] report that the disease was of major economic significance to the industry, prior to the widespread use of vaccines in the 1960s. However, vaccines did not become available in Australia until the 1980s, and control of the disease in Australia before that time was by controlled exposure and infection of pullets prior to coming into lay.[66] Morbidity from the naturally occurring disease usually is only seen in young stock. If all chicks are from an infected flock, morbidity of 40-60% can be observed. Mortality averages 25% and can exceed 50%. These rates are lower if many of the chicks in the flock originate from immune breeder flocks. [64]

Occurrence in Australia

Avian encephalomyelitis is present in Australia, where it is controlled by vaccination.[63]

18 Avian spirochaetosis

Agent infects domestic chicken

Spirochaetosis is a tick-borne disease caused by a spirochaete, *Borrelia anserina*. There are many immunologically distinct strains of *Borrelia anserina* with virulence differing between strains. Only one strain of *Borrelia anserina* has been isolated in Australia[67]. The natural hosts of *Borrelia anserina* are the chicken, turkey, duck, goose and pheasant. Disease has been recorded in parrots and other wild birds that have been infected experimentally.[68]

Potential for transmission in chicken meat

Major lesions are found in spleen, liver and kidney. Offals and potentially carcases of infected birds may therefore contain the organism,[68] although transmission of the disease is unlikely to occur due to the necessity for an arthropod vector.

Potential for adverse consequences

Morbidity and mortality are highly variable, ranging from 1-2% to 100%. Highest rates occur when susceptible birds are placed in an environment infested with infected ticks, or when tick-infested birds are mixed with susceptible birds. Either situation may lead to explosive outbreaks with high morbidity and mortality.[68]

Occurrence in Australia

Spirochaetosis has been reported from many areas of the world, including Australia.[63] In Australia, it occurs in warm climates where the fowl tick, *Argas persicus*, can survive and breed.[67]

19 *Salmonella* Enteritidis

Agent infects domestic chicken

S. Enteritidis is commonly isolated from chickens and causes human illness in many countries. [69]

Potential for transmission in chicken meat

Salmonella Enteritidis phage type 4 and phage type 8 harboured in the digestive tract of poultry has been incriminated as a causative agent of severe food poisoning outbreaks in humans in several countries.[69]

Potential for adverse consequences

Since the 1980s, *Salmonella* Enteritidis phage types 4 and 8 harboured in the digestive tract of chickens have been responsible for a number of serious food poisoning outbreaks associated with consumption of poultry products in several countries.[69,70] Zoonotic infections with bacteria resistant to all or most of the antibiotics could occur in the young, the aged, and the immuno-compromised humans resulting in serious infections and sometimes death.

Apart from the risk to human health posed by these zoonotic organisms, there is a risk that demand for poultry products would fall significantly, should the organisms become prevalent in Australian poultry flocks. This has been the case overseas.

Occurrence in Australia

Salmonella Enteritidis is the second most common serovar of *Salmonella* isolated from humans at the Australian Salmonella Reference Centre over the past 4 years (1996-99), and represented 8% of *Salmonella* isolations (from humans) in 1998 and 1999. In 1999, *Salmonella* Enteritidis PT4 represented over 40% of the reported isolates from humans. However, all cases of *S.* Enteritidis were reported from humans,[60] and these infections derive from overseas travellers.

There have been anecdotal reports of *S.* Enteritidis infection from table eggs in North

Queensland in the early 1990s.

S Enteritidis was isolated from a backyard flock of layers in Victoria in the mid 1990s. The owner of the flock was affected by severe gastroenteritis on return from travelling overseas. During investigation of the disease, samples were taken from the backyard chickens, and *S* Enteritidis identical to that recovered from the human patients was found. The flock was destroyed.

Investigation of an outbreak of *S.* Enteritidis PT 4 in humans in Tasmania in June of 2000 identified a layer flock as a possible source. Preliminary typing of *S* Enteritidis isolated from manure samples from the farm revealed that the isolate was Phage Type 1, but further work is being undertaken to confirm the typing. No *Salmonellae* have been isolated from the live birds to date. Investigation of this outbreak was still in progress as at October 2000.

20 *Salmonella* Typhimurium

Agent infects domestic chicken

S. Typhimurium is commonly isolated from chickens.

Potential for transmission in chicken meat

Multi-drug-resistant *Salmonella* Typhimurium such as DT 104 and other multi drug resistant strains from food producing animals including avian species has been widely reported in the scientific literature as a cause of human disease.[71]

Potential for adverse consequences

It is well known in the scientific community that antibiotics such as ampicillin, chloramphenicol, streptomycin, sulphonamides, and tetracyclines, have become ineffective in treating infections caused by *Salmonella* Typhimurium phage type DT104. Zoonotic infections with bacteria resistant to all or most of the antibiotics could occur in the young, the aged, and the immuno-compromised humans resulting in serious infections and sometimes death. Antibiotic resistant strains of bacteria are therefore considered to be of quarantine concern, where it can be shown that recognisably different strains with different levels of resistance exist. Antibiotic resistance is defined in the JETACAR Report [72] as a property of bacteria that confers the capacity to grow in the presence of antibiotic levels that would normally suppress growth or kill susceptible bacteria. An organism is said to have become resistant to an antibiotic when the minimum inhibitory concentration (MIC) is significantly higher (>4 times) than the sensitive parent or than the range of MICs found in the same species not previously exposed to the antibiotic. Multiple drug resistance is defined as resistance to two or more antibiotics from different chemical classes.

Apart from the risk to human health posed by these zoonotic organisms, there is a risk that demand for poultry products would fall significantly, should the organisms become prevalent in Australian poultry flocks. This has been the case overseas.

Occurrence in Australia

The Australian Salmonella Reference Centre reported that *S.* Typhimurium was the most common *Salmonella* recovered from humans, and the second most common *Salmonella* from chickens in 1999.[60] Infection with *S.* Typhimurium DT104 is rare in humans in Australia and the reported outbreaks are generally associated with recent overseas travel and particularly in those returning from South East Asia. From January 1985 to May 1995, 49 cases of human DT 104 infection were notified to the NEPSS.[73] Of these, 19 infections were clearly identified as acquired outside Australia, notably in Southeast Asia. The Australian Salmonella Reference Centre reported no cases of *S.* Typhimurium DT104 in 1999.[60]

21 Avian leucosis-sarcoma complex

Agent infects domestic chicken

Chickens are the natural hosts for all viruses of the leucosis-sarcoma group, which are avian type C retroviruses.[74] They have not been isolated from other avian species except pheasants, partridges, and quail. Experimentally, some viruses have a wide host range and can be adapted to grow in unusual hosts, including chickens, pheasants, guinea fowl, ducks, pigeons, Japanese quail, turkeys and rock partridges.[75]

Potential for transmission in chicken meat

The retroviruses cause a wide range of tumours that may affect circulating blood cells or solid tumours, which localise in the bursa, liver, spleen, kidney or other tissues. The viruses may insert genes into the nucleic acid of infected cells, and in some cases can be directly vertically transmitted in the transferred genetic material.[74] Chicken carcases or chicken meat could therefore be contaminated with the virus. Natural transmission may be either vertical, or horizontal. Horizontal transmission is by direct contact between infected and susceptible birds. Indirect contact is not considered to be a major route of transmission, because of the poor survival of the virus outside the host.[75] It is therefore considered that chicken meat does not pose a risk of transmission of avian leucosis/sarcoma virus.

Potential for adverse consequences

Most commercial chickens are exposed to lymphoid leucosis viruses, but commonly fewer than 3% develop tumours, although morbidity may reach 30% in some cases. Other losses due to this disease are associated with decreased egg production, reduced hatchability and decreased growth rates.[74]

Occurrence in Australia

Avian leucosis occurs throughout the world. It is present in Australia.[63] Some groups may be exotic. Subgroup J, which has recently emerged as a significant problem in the international poultry industry, is present in Australia. Within the leucosis J subgroup, antigenic variations occur and it is suspected that there are differences in virulence.[76]

22 Angara disease (AAV type 1)

Agent infects domestic chicken

Hydropericardium-hepatitis syndrome (HHS) or Angara disease is an acute, infectious disease of chickens, which is believed to be caused by a Type 1 avian adenovirus. There is some evidence that there may be a multi-factorial aetiology, involving an RNA virus in addition to the adenovirus.[77] However, both HHS and inclusion body hepatitis have been reproduced experimentally by infection with serotype 4 and serotype 8 avian adenoviruses.

Potential for transmission in chicken meat

3-5 week old broilers are typically affected. After 3 weeks of age, progeny of infected stock may excrete virus for up to 14 weeks.[77] Lesions include quantities of clear transudate in the pericardial sac, with generalised congestion, pulmonary oedema, and enlarged, pale friable kidneys and liver. Adenoviruses are found in faeces, tracheal and nasal mucosa, and kidneys, but highest titres are found in the faeces.[78] This indicates that carcases of infected chickens may well be contaminated with the virus. Spread by fomites is considered to be important, so it is possible that chicken meat may serve to transmit the infection to susceptible Australian birds.

Potential for adverse consequences

Prevalence and severity of outbreaks are related to the density of the poultry population in an area. Duration of infection usually ranges from 9-14 days, with morbidity of 10-30% and daily mortality of 3-5%. Mortality as high as 80% can be observed if the birds are also exposed to VV Newcastle disease, or vvIBDV.[77]

Occurrence in Australia

Angara disease has not been reported in Australia, although other type 1 avian adenovirus infections do occur here.

23 Quail bronchitis (AAV type 1)

Agent infects domestic chicken

Quail bronchitis (QB) is an acute, highly contagious fatal respiratory disease of young bobwhite quail, caused by a Type 1 avian adenovirus. Quail bronchitis virus (QBV) is infectious for domestic poultry, including chickens, but infection is usually

asymptomatic in these species. These birds may serve as a vector for QBV.[79]

Potential for transmission in chicken meat

Transmission of the virus is not fully understood, but it appears from studies of other avian adenoviruses that faecal-oral or mechanical transmission are likely. QBV has been isolated from cecal tonsils during experimental infections.[79]It is therefore possible that carcases of slaughtered asymptomatic chickens may serve as a mechanical vector to introduce the virus to Australia.

Potential for adverse consequences

QB is often a catastrophic disease of captive-reared bobwhite quail with morbidity and mortality from field cases exceeding 50% in some cases.[79] While the quail industry in Australia is small, this disease has potentially serious adverse effects for this industry.

Occurrence in Australia

The disease has not been reported in Australia although other type 1 avian adenovirus infections do occur here.

24 Avian adenovirus splenomegaly disease (AAV type 2)

Appropriate to animal species

Avian adenovirus splenomegaly (AAS) is a disease of chickens and other gallinaceous birds, caused by a Type 2 avian adenovirus.[80] In turkeys the virus causes a disease referred to as Haemorrhagic enteritis of turkeys.

Appropriate to commodity

Field infections are seen as splenomegaly in young or market aged broilers, or as splenomegaly with pulmonary congestion in mature birds.[80] Carcases or meat derived from birds slaughtered while infected could therefore contain the virus.

Potential for adverse consequences

Up to 9% mortality has been reported in mature birds with AAS. [80]

Occurrence in Australia

Haemorrhagic enteritis of turkeys has been known in Australia for approximately 20 years.

25 Egg drop syndrome 1976 (AAV type 3)

Agent infects domestic chicken

Egg drop syndrome 1976 is caused by a Type 3 avian adenovirus. Disease outbreaks have only been observed in laying hens. However, the natural hosts of the virus are probably ducks and geese. Quail are also susceptible to infection and develop classical

clinical signs. Antibody has been found in a wide variety of wild ducks, as well as mergansers, coots, grebes, cattle egrets, gulls, owls, a stork and a swan.[81]

Potential for transmission in chicken meat

Whilst egg transmission is the principal method of dissemination of the virus, ingestion of virus-contaminated faeces is important in the spread of the disease. Infection of chickens from wild birds through faeces-contaminated water has been reported.[81] There is no recorded evidence of spread in chicken meat. However, faecal contamination of carcases during processing could lead to the virus being present on imported meat. This means that there is a possibility that contaminated chicken meat could lead to transmission of this virus.

Potential for adverse consequences

Egg drop syndrome is one of the major causes of lost egg production throughout the world. Once established in a breeding organisation, it is most often recognised as a failure to achieve production targets.[81]

Occurrence in Australia

Egg drop syndrome has been reported in Australia,[82] and is controlled by vaccination and biosecurity measures, including treatment of water supplies.[81]

26 Avian nephritis

Agent infects domestic chicken

Avian nephritis virus (ANV) disease is caused by a picornavirus. Several serotypes and strains have been identified. Imada and Kawamura[83] state that ANV disease is confined to the chicken, and that antibody has been found in turkeys. However, Ritchie[65] states that the disease has been seen in young turkeys.

Appropriate to commodity

Gross lesions are found in the kidneys,[83] indicating that the virus could be introduced into Australia in the carcases of infected birds. Transmission readily occurs by direct and indirect contact. This indicates that chicken meat has the potential to transmit the disease to susceptible Australian birds.

Potential for adverse consequences

Avian nephritis virus causes renal disease in young chickens and turkeys. Affected chicks may remain asymptomatic or exhibit reduced weight loss.[65]

Occurrence in Australia

ANV occurs worldwide including Australia.

27 Campylobacteriosis

Agent infects domestic chicken

Campylobacteriosis is caused by an infection with the thermophilic species of *Campylobacter*, a gram negative, spiral, uniflagellate motile bacteria. *C jejuni* is the predominant *Campylobacter* isolate from birds and it is an important food-born zoonosis.

Potential for transmission in chicken meat

Campylobacter is commonly a cause of food poisoning from consumption of contaminated poultry products.

Potential for adverse consequences

Infection with antibiotic resistant strains is a serious zoonosis. Human health concerns are of major importance.

Occurrence in Australia

Different serovars have been identified but there is little difference in pathogenicity between strains. Antibiotic resistance is widespread and differs between countries. Resistance to erythromycin and tetracycline are relatively common in Australian isolates. However, no resistance to fluroquinolones has been demonstrated in Australia.[72] Therefore it is considered that fluroquinolone-resistant strains of *Campylobacter* should be further considered in the risk analysis.

28 Chicken infectious anaemia (Chicken anaemia agent)

Agent infects domestic chicken

Chicken infectious anaemia virus (CIAV) is a small non-enveloped single stranded DNA virus assigned to the circovirus family. The chicken is the natural host.[84]

Potential for transmission in chicken meat

Lesions due to chicken anaemia agent occur commonly in the thymus and bone marrow[84] Natural transmission occurs by both horizontal and vertical routes. There is a high concentration of virus in the faeces of infected chickens at 5-7 weeks after infection. Horizontal infection is most likely by the oral route. Therefore it is possible that the carcases of infected chickens may contain, or be contaminated with faeces containing, the virus.

Potential for adverse consequences

There have been many reported outbreaks of disease associated with chicken anaemia agent. Disease occurs in chickens at 2-4 weeks of age. Growth retardation occurred, and mortalities of 10-60% have been reported.[84]

Occurrence in Australia

CAV has a worldwide distribution and occurs in Australia. [84]

29 Derszy's disease (Goose parvovirus infection)

Agent infects domestic chicken

This disease has only been reported from geese and Muscovy ducks. It has not been recorded in chickens.[85]

Potential for transmission in chicken meat

Since the disease does not occur in chickens, chicken meat cannot be a source of infection for Australia.

Potential for adverse consequences

The disease is strictly age dependent. In young goslings (under 1 week), 100% mortality may occur. By 4-5 weeks of age, negligible losses will occur. In older birds, seroconversion occurs, but clinical disease does not occur.[85]

Occurrence in Australia

This disease has not been reported to occur in Australia.

30 Entero-haemorrhagic *Escherichia coli* (EHEC) infections

Agent infects domestic chicken

Escherichia coli is a common inhabitant of the alimentary tract, and depending on the serotype and number of organisms can result in disease. It is of major importance to the chicken and duck industries.

Potential for transmission in chicken meat

Birds may be infected with human pathogenic forms and provide a zoonotic threat through food products derived from birds, including chicken meat. Strains of enterohaemorrhagic *E. coli* (EHEC), such as those of serovar O157:H7, are of most concern.

Potential for adverse consequences

Highly pathogenic human serovars that infect birds may be present in imported chicken meat. The pathogen can have a significant effect on avian and public health.

Occurrence in Australia

E. coli is distributed throughout the world. However, serovars may be restricted geographically. The three most commonly isolated serovars in Australia are 01:K1(L), 02:K1(L) and 078:K80(B).[86] Exotic strains exist.

31 Japanese encephalitis

Agent infects domestic chicken

Evidence of Japanese encephalitis has been reported in poultry and other birds,[87] although it is of clinical significance in pigs, horses and man.[15] Haemagglutination inhibition (HI) antibodies to Japanese encephalitis virus were found in 17.18% of duck samples, 13.68% of chicken samples and 4.2% of other birds.[87] Birds form part of the life cycle between insect and animal and are often amplifying hosts.

Potential for transmission in chicken meat

Although it is possible that Japanese encephalitis virus may be present in imported meat, JE is a mosquito–born disease,[15] and therefore imported chicken meat does not pose a risk of establishment and spread of the disease in this country.

Potential for adverse consequences

There is no potential for adverse consequences in avian species, but pregnant sows may abort, produce mummified foetuses or give birth to still-borne or weak piglets at term. CNS signs indicative of encephalitis may be seen in young piglets.[15] Three separate clinical syndromes are seen in horses, with mortality ranging from approx 5% to 30-40% in severe outbreaks.[15] The disease also causes encephalitis in humans.[15]

Occurrence in Australia

There has been serological evidence of infection in sentinel pig herds on the Cape York Peninsula. Human disease has been reported from islands in the Torres Strait,[88] and there has been a single report of disease in a fisherman working at Mitchell River in the Gulf of Carpentaria.[89]

32 Muscovy duck parvovirus

Agent infects domestic chicken

Only muscovy ducks are susceptible to muscovy duck parvovirus.[90] It has not been recorded in chickens.

Potential for transmission in chicken meat

Since the disease does not occur in chickens, chicken meat cannot be a source of infection for Australia.

Potential for adverse consequences

In young muscovy ducklings, the disease causes enteric, locomotor and nervous signs, and abnormal feather development. It is characterised by high mortality.[90]

Occurrence in Australia

Muscovy duck parvovirus is not known to have occurred outside the Brittany area of

Western France, where it was originally reported in 1989.[90]

33 Mycoplasmosis (*M.meleagridis*)

Agent infects domestic chicken

Mycoplasma meleagridis is a specific pathogen of turkeys.[91]

Potential for transmission in chicken meat

M meleagridis does not occur in chickens and therefore is not a contaminant of chicken carcases.

Potential for adverse consequences

M meleagridis causes late incubation mortality in infected turkey flocks. Under commercial conditions, and if the disease is uncontrolled, it can cause a 5-6% decrease in hatchability.[91]

Occurrence in Australia

M. meleagridis is present in Australia.

34 Mycoplasmosis (*M. iowae*)

Agent infects domestic chicken

The natural host of *Mycoplasma iowae* is the turkey, but infections in chickens are not uncommon.[92]

Potential for transmission in chicken meat

M iowae causes, *inter alia,* hepatitis, splenomegaly, and air sacculitis.[92] The agent may be a contaminant of carcases of slaughtered chickens and turkeys. However, spread of the organism appears to be restricted to direct contact.

Potential for adverse consequences

M. iowae causes embryo mortality and decreased hatchability in turkey flocks. The extent of the decrease in reproductive performance is widely variable, ranging from zero to severe and prolonged depression of production.[92]

Occurrence in Australia

M iowae is exotic to Australia.

35 Mycoplasmosis (*M. synoviae*)

Agent infects domestic chicken

Chickens, turkeys and guinea fowls are the natural hosts of *M. synoviae*. Ducks, geese, pigeons, Japanese quail, and red-legged partridge have also been found to be naturally infected, while pheasants and budgerigars have been shown to be susceptible

to infection following artificial inoculation.[93]

Potential for transmission in chicken meat

M. synoviae infection causes infectious synovitis, primarily in 4–12 weeks old hosts. Clinical signs include lameness, pale combs that then shrink, retarded growth, and ruffled feathers. Breast blisters and swelling of hock joints and footpads are common. Generalised infection may also cause birds to become listless, dehydrated and emaciated. The acute disease is followed by a slow recovery, though synovitis may persist for life. Generalised infections can occur. Air sac infection may occur at any age, but is commonly seen as a cause of condemnation in broilers. [93]The disease agent may contaminate the carcase of slaughtered broilers. However, spread is similar to that seen in *M. gallisepticum* infection (ie transmission of disease appears to be by direct contact with susceptible birds, or by contaminated airborne dust, droplets or feathers). It is therefore unlikely that chicken meat will be able to transmit the infections to susceptible Australian birds.

Potential for adverse consequences

M. synoviae infection causes 2-75% morbidity in flocks with clinical synovitis. 5-15% morbidity is most common. Mortality ranges from 1–10%.[93]

Occurrence in Australia

M. synoviae is present in Australia.

36 Ornithobacteriosis

Agent infects domestic chicken

O rhinotracheale is a respiratory pathogen of chicken and turkeys but has been isolated from numerous species including partridge, pigeon, ducks and quail.

Potential for transmission in chicken meat

O. rhinotracheale is isolated from the respiratory tract and thus spread of the disease is most likely through inhalation or ingestion of respiratory secretions. The bacterium may also be present in joints, heart, brain, liver and the vertebrae.[94] The bacterium may therefore be present on carcases of infected birds.

Potential for adverse consequences

Acute and chronic forms of ornithobacteriosis exist and the clinical signs, the course and severity of the disease are highly variable. airsacculitis and pneumonia are the predominant features of the disease. However, osteitis and encephalitis due to *O. rhinotracheale* without accompanying respiratory signs, have been reported.[95]

In the layer, reduced egg production and quality of the egg and eggshell accompany respiratory disease. Growth rate is reduced in broilers.

Whilst the mortality rate is generally low, ranging from 2% to 11% in chickens and turkeys,[96] ornithobacteriosis has a significant impact on production. It is considered to be highly contagious disease.[95]

Occurrence in Australia

O rhinotracheale has not been isolated in New Zealand or Australia. It was first isolated in 1981 and has subsequently been reported in Canada, USA, Europe, Israel, and South Africa.[96] Van Empel and Hafez[95] report serological evidence of *O rhinotracheale* in South America and Asia.

37 *Riemerella anatipestifer* infection

Agent infects domestic chicken

Riemerella anatipestifer infection is a contagious disease that primarily affects ducks. Serious outbreaks have also occurred in turkeys. The agent has also been isolated from pheasants, chickens, guinea fowl, and quail, partridge and other waterfowl.[97]

Potential for transmission in chicken meat

The disease causes fibrinous exudate involving serosal surfaces generally, but particularly affecting the pericardial cavity and the surface of the liver. Fibrinous airsacculitis is common. Lesions may also be seen in the liver, and spleen. Chronic localised infections may occur in the skin and joints. The disease is particularly severe in young ducks, and death may occur in 1-2 days in ducklings under 5 weeks of age. Older birds may survive longer.[97] This indicates that it is likely that the carcases of slaughtered birds may be contaminated with the organism, and could introduce it into Australia. Attempts to reproduce the disease by oral inoculation have however, been unsuccessful.[97] It is therefore considered unlikely that chicken meat would be able to transmit the infection to susceptible Australian birds.

Potential for adverse consequences

The disease accounts for major economic loss to the duck industry due to high mortality, weight loss and carcase condemnations. Mortality in young birds may vary from 5-75% depending on age, environmental conditions and concomitant disease.[97]

Occurrence in Australia

The disease has been reported in ducks in Australia by a number of authors.[98-103] However, it is believed that there are serotypes that occur commonly overseas, but have not been reported in Australia.

38 Reovirus infection

Agent infects domestic chicken

Avian reoviruses have been found associated with a variety of diseases in chickens, turkeys, ducks, geese, American woodcock, and psittacine species. Disease syndromes that have been associated with reovirus infections include arthritis/tenosynovitis, stunting syndrome, respiratory disease, enteric disease, and malabsorption syndrome.[104]

Potential for transmission in chicken meat

Horizontal transmission of reovirus infection seems to be mainly by faecal contamination, although the virus can be excreted from both respiratory and gastrointestinal tracts for at least 10 days post-inoculation.[104] Faecal contamination of carcases of infected birds during processing could serve to introduce the virus into Australia.

Potential for adverse consequences

Economic losses due to reovirus infection are largely related to crippling effects of arthritis/tenosynovitis, and a general lack of performance. Performance problems include diminished weight gains, poor feed conversion, and reduced marketability. [104]

Occurrence in Australia

Reoviruses have been regularly isolated from chickens in Australia.[105-109]

39 Reticuloendotheliosis

Agent infects domestic chicken

Natural hosts for Reticuloendotheliosis virus include turkeys, chickens, ducks, geese, pheasants, and Japanese quail. Guinea fowl have also been infected experimentally.[110]

Potential for transmission in chicken meat

Virus has been detected in faeces and cloacal swabs, and in other body fluids.[110] Carcases contaminated with body fluids during processing could introduce the virus into Australia. However, horizontal transmission appears to be by direct contact only, and transmission was not detected when birds were separated by wire mesh.[110] It is therefore considered unlikely that chicken meat could transmit the disease to susceptible Australian birds.

Potential for adverse consequences

Witter[110] suggests that the disease is not a major economic problem for the poultry industry, since it is generally sporadic and self limiting.

Occurrence in Australia

The virus occurs worldwide and is present in Australia.[111] Bagust and Dennett[112]

concluded that REV occurs as a natural infection in Australian poultry flocks.

40 Transmissible viral proventriculitis

Agent infects domestic chicken

Transmissible viral proventriculitis is a disease which has only been reported under natural conditions from commercially raised broilers.[113]

Potential for transmission in chicken meat

The disease has been shown to be transmitted experimentally by oral and intracoelomic inoculations with homogenates of proventricular material. The virus has been demonstrated in proventriculus, ventriculus and in gut associated lymphoid tissue,[113] and could be present in imported chicken meat.

Potential for adverse consequences

The disease causes stunted growth, pallor, unthriftiness and poor feed conversion.[113]

Occurrence in Australia

The disease has been reported in Australia, as well as from the United States and Holland.[113]

41 Turkey coronavirus enteritis

Agent infects domestic chicken

Coronaviral enteritis is an acute, highly infectious disease that affects turkeys of all ages. Chickens, pheasants, seagulls, coturnix quail, and hamsters are refractory to infection.[114]

Potential for transmission in chicken meat

Since chickens are refractory to infection, chicken meat would not serve as a means of introduction of the virus to Australia

Potential for adverse consequences

Morbidity approaches 100%. This leads to economic loss associated with weight loss and inability of the flock to grow at the normal rate. Mortality in young poults ranges from 50-100% and in older birds may approach 50%.[114]

Occurrence in Australia

The disease has been reported in several States in the USA, Canada and Australia.[114]

42 Turkey rhinotracheitis.

Agent infects domestic chicken

TRT is an acute, highly infectious and contagious disease of turkeys, caused by an avian pneumovirus. TRTV has also been associated with swollen head syndrome in

chickens[115,116]. Natural infections also occur in guinea fowls[116] and pheasants[117].

Potential for transmission in chicken meat

The primary site of infection of the virus is the respiratory tract epithelial tissues. The virus is present in the lungs and the trachea. The concentration of the virus is higher, if there is secondary infection. The remnant lung tissue left after processing can contaminate the carcase. Since the virus can be spread rapidly in the air for long distances it is highly likely that cross contamination of carcases will occur in the abattoir environment.

Potential for adverse consequences

In infected flocks the morbidity rates are 100% and the mortality rates vary widely and can reach up to 85%.[118]

Occurrence in Australia

Turkey rhinotracheitis virus (TRTV) is widely prevalent in many parts of the world and the virus has been isolated in countries in the African continent, the USA, England, France, Italy, Spain, Germany, Hungary,[119,120] and Israel[121] TRTV is not present in Australia [122].

43 Eastern equine encephalomyelitis/Western equine encephalomyelitis/Venezuelan equine encephalomyelitis

Agent infects domestic chicken

Eastern equine encephalomyelitis (EEE) has caused significant pathogenicity in pheasants,[123] and has been associated with high mortality occurred in commercial turkey hens in southern North Carolina in autumn 1991.[124] Western and Venezuelan equine encephalomyelitis have caused mortalities in domestic fowl and farmed pheasants, quail, emus and ostriches.[15] Egg production drops have been reported in turkey flocks associated with WEE.[125]

Two emus (pen mates) died in Georgia with acute haemorrhagic enterocolitis. Eastern equine encephalomyelitis (EEE) virus was isolated in Vero cells from non-pooled samples of brain and intestine. Enterocolitis with splenic and hepatic necrosis was reproduced by i.m. or oral inoculation of this isolate in 2 ostriches and 3 turkey poults.[126]

Potential for transmission in chicken meat

EEE, WEE and VEE are arthropod borne diseases. They are therefore not likely to be introduced into Australia in chicken meat.[15]

Potential for adverse consequences

In addirtion to the high mortality and production diseases referred to above, the

diseases can cause mortality in horses, and in humans.[15] The susceptibility of emus suggests that this disease could pose a serious threat to the Australian environment, should it become established here.

Occurrence in Australia

None of these alphavirus diseases has been reported in Australia.[15]

44 West Nile virus

Agent infects domestic chicken

West Nile virus has been reported in poultry and other birds. Birds form part of the life cycle between insect and animal and are often amplifying hosts.

Potential for transmission in chicken meat

The disease is vector-mediated and as such does not pose a hazard in chicken meat.

Potential for adverse consequences

While it is unlikely that this disease would cause significant loss to the poultry industries, it is a serious zoonotic disease, and has caused deaths in humans. It also affects horses, and may cause death. Humans and horses are considered to be "dead-end" hosts.

Occurrence in Australia

West Nile virus has not been reported in Australia.

CONCLUSIONS: HAZARD IDENTIFICATION

On the basis of these discussions, the following disease agents were retained for further consideration in the IRA.

OIE List A diseases

Highly pathogenic avian influenza

Newcastle disease

OIE List B diseases

Fowl typhoid

Infectious bursal disease

Pullorum disease

Salmonella Enteritidis infection

Salmonella Typhimurium infection

Other diseases/disease agents

Angara disease

Quail bronchitis

Avian adenovirus splenomegaly disease

Campylobacteriosis

Escherichia coli (EHEC) infection

Ornithobacteriosis

Turkey rhinotracheitis

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