# On-farm Biosecurity Risk Identification Framework for the Australian layer industry

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A report for Australian Eggs Limited by

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# Foreword

This report is designed as a support tool for Australian egg producers when determining biosecurity risks on-farm. Egg producers cannot be expected to adequately undertake an on-farm risk assessment without first understanding what constitutes a risk, and why. Biosecurity helps to protect hens from diseases that may cause morbidity or mortality, but also identifies food safety pathogens that may cause human illness (e.g. *Salmonella*). Minimising the incidence of disease in layers and the presence of human food safety pathogens are critical in maintaining a viable egg business.

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This report is an addition to Australian Eggs Limited's range of peer reviewed research publications and an output of our R&D program, which aims to support improved efficiency, sustainability, product quality, education and technology transfer in the Australian egg industry.

Most of our publications are available for viewing or downloading through our website:

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Printed copies of this report are available for a nominal postage and handling fee, and can be requested by phoning (02) 9409 6999 or emailing research@australianeggs.org.au.

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# About the Authors

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Dr Greg Underwood is a specialist poultry veterinarian with 25 years' experience in the Australian poultry industry. Greg holds a PhD from the University of Bristol in infectious diseases of poultry, and has an interest in exotic disease outbreak management having served as the Industry Liaison Officer of the 2013 Avian Influenza outbreak in Young, and as a Government officer for the Avian Influenza outbreak in Tamworth, 1997. Greg has held senior executive positions in egg layer and meat breeding companies and vaccine manufacturing companies. Greg has served on the Australian Egg Industry Consultative Committee and is a current member of the AgriFutures Chicken Meat advisory panel, and is a consultant to the Australian poultry industry.

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# Abbreviations

| | |
|---|---|
| AE | Avian Encephalomyelitis |
| AECL | The Australian Egg Corporation Limited (now Australian Eggs Limited) |
| AHA | Animal Health Australia |
| AI | Avian Influenza |
| EAD | Emergency Animal Disease |
| EDS | Egg Drop Syndrome |
| HPAIV | Highly Pathogenic Avian Influenza Virus |
| IBV | Infectious Bronchitis Virus |
| ILT | Infectious Laryngotracheitis |
| MD | Marek's Disease |
| MDV | Marek's Disease Virus |
| ND | Newcastle Disease |
| NDV | Newcastle Disease Virus |
| vvIBD | very virulent Infectious Bursal Disease |
| vvIBDV | very virulent Infectious Bursal Disease Virus |

# 1 Introduction

In Australia, the egg industry is an important, intensive animal production system. The industry comprises several large producers, which make up approximately 50% of the national flock numbers, as well as medium sized producers, an increasing number of small niche market segments, and some backyard production. There were 6.2 billion eggs produced in the 2017-18 financial year, which is an average of 16.9m eggs per day. Egg consumption in Australia has risen strongly over the past decade, effectively doubling to 245 eggs per person per year in September 2018, or 4.7 eggs per person per week. This represents a total industry value of $819.6m. Currently, Australia does not import intact shell eggs for human consumption due to biosecurity risks. Imported egg products are either preserved, cooked, pulped, or in powder form (Australia Eggs Ltd, 2018).

There are three egg production systems in Australia: cage, barn, and free range. Organic egg production is a niche segment within free range. Eggs are produced in all states and the Australian Capital Territory, and there are some small free range farms in the Northern Territory. New South Wales/Australian Capital Territory (~32%), Queensland (~28%) and Victoria (~22%) produce most of the overall egg production in Australia, with Western Australia contributing 11%, South Australia 7% and Tasmania less than 0.5% (Australia Eggs Ltd, 2018). There are also several breeding facilities spread throughout these states and territories.

Biosecurity is an integral part of any successful poultry production system. As defined in the National Farm Biosecurity Technical Manual for Egg Production (AHA, 2015), biosecurity refers to those measures taken to prevent or control the introduction and spread of infectious agents to a Flock. Such infectious agents, whether they cause clinical or subclinical disease to hens or human foodborne illness (e.g. *Salmonella*), can significantly reduce the productivity, profitability and long-term financial viability of a poultry operation and potentially the entire industry.

Currently, the level of understanding of biosecurity varies across the industry. However, as this is a technically complex issue with varying risks (and varying understandings of the risks) between farms and other horizontal contacts, an effective management strategy will need to: 1) be a collaborative effort that relies on the development of good relationships between industry, ancillary service providers and government agencies/regulators; 2) be founded on objective information; and 3) involve a system (or systems) to control biosecurity risks on-farm and with associated contacts.

Each producer has a responsibility to identify and address their own biosecurity risks. Due to the complexities associated with biosecurity risk assessment, producers require guidance from experts in this field to ensure they cover the scope (risk identification), impact (risk likelihood and consequence rating), and have insight to control options (risk management). Important factors that can impact on farm biosecurity include:

- layout and boundaries of the Property and Production Area (natural and man-made)
- regional disease challenges
- proximity to other Production Areas with avian and/or porcine species
- proximity to large water bodies
- presence and type of wildlife in the area (especially waterfowl)
- live poultry movement outside the boundary of the Property
- choice and implementation of vaccination and health management programs
- source of water and feed supply
- movement of personnel, contractors, vehicles and equipment, especially their contact with other poultry/poultry products, and
- egg handling and cartage (especially fillers).

Australian Eggs has recently updated and produced the National Farm Biosecurity Technical Manual for Egg Production (AHA, 2015), in conjunction with Animal Health Australia, and facilitates knowledge sharing with other poultry industries as to what constitutes risk on a poultry farm in general. This current report captures the risks laid out in the National Farm Biosecurity Technical Manual for Egg Production and highlights why each is considered a risk – this is essential when explaining concepts and motivating action – and potential options for how these risks could be managed. Each farming operation is different, so the focus of each risk assessment, the level of risk for each site (likelihood and consequence), and the mitigation options require a customised approach for each site and, ideally, involve the key farm stakeholders, especially management, veterinarians and employees.

# 2 Principles of biosecurity

Biosecurity helps to protect hens from pathogens that may cause diseases that result in morbidity, mortality or reduction in egg production, and also food safety pathogens that may cause human illness (e.g. *Salmonella*). Minimising the incidence of disease in layer hens, and the presence of human food safety pathogens, are critical in maintaining a viable egg business.

## 2.1 Definitions

This report follows the flow of direct and indirect contacts, or 'risks', from outside the Property to the Flock (Figure 1). The definitions used in this document are aligned with the National Farm Biosecurity Technical Manual (AHA, 2015) and include:

**Biosecurity** is the principle of prevention and control of the transfer of micro-organisms that can cause disease to humans or animals.

**Flock** refers to all commercial poultry on the farm, regardless of age or housing environment.

**Horizontal contact points** include regional and supplier/customer contacts that may be direct or indirect with other poultry or avian pathogens, including: litter source/disposal; new stock; spent hen disposal; transport vehicles; other farms/regional poultry farms.

**Production Area** refers to the poultry sheds, including range, entry foyer and air intake areas, egg collection, grading and storage areas, feed production and storage areas, dry stores, loading pads and roadways in the immediate vicinity of the poultry houses.

**Property** refers to the land and buildings within an external perimeter fence that people, livestock and vehicles regularly access, including: the Production Area; dead bird storage; water supply and treatment; equipment storage; on-farm vehicles; manager's residence and staff amenities.

**Risk** refers to the probability that a procedure, contact, or feature could lead to the transfer of pathogens to the Flock.

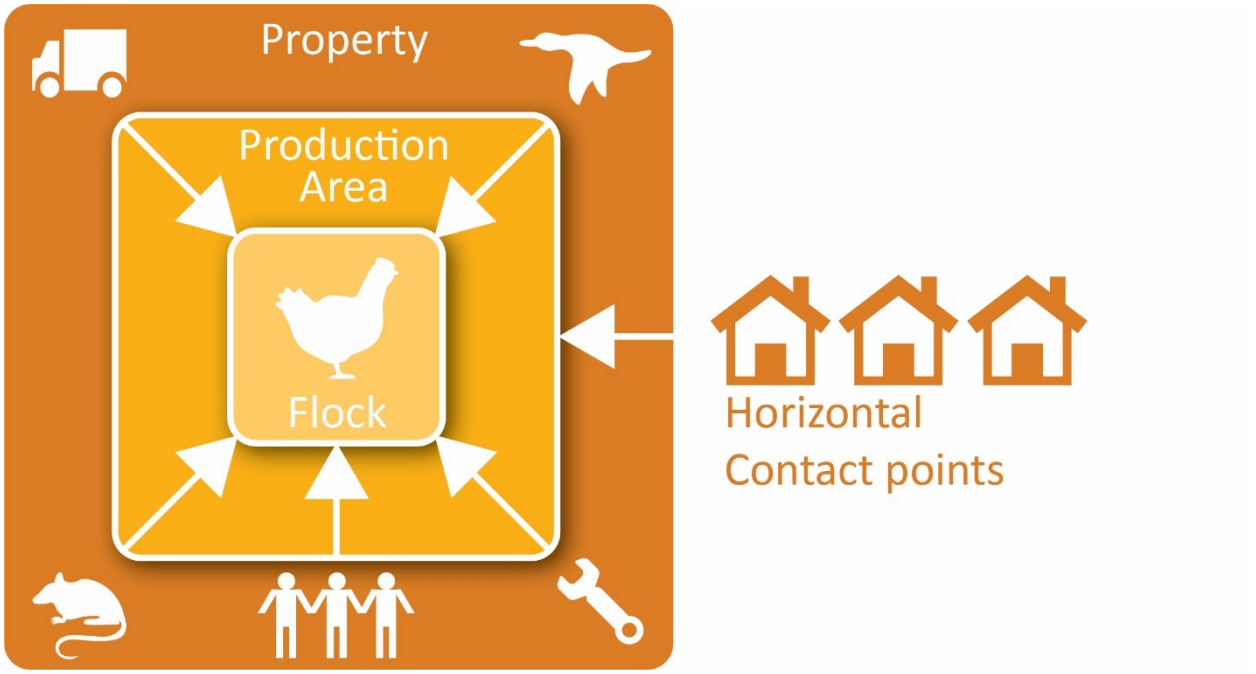


**Figure 1 Flow of biosecurity risk to layer hens**

## 2.2 Emergency animal diseases

Emergency Animal Disease (EAD) is a disease that has met one or more of the following criteria:

- It is a known disease that does not occur in endemic form in Australia, including (without limitation) the diseases that are in the national interest to be free of.
- It is a variant form of an endemic disease, which is itself not endemic, caused by a strain or type of the agent, which can be distinguished by appropriate diagnostic methods, and which if established in Australia would have a negative national impact.
- It is a serious infectious disease of unknown or uncertain cause, which may be an entirely new disease based on the evidence available at the time.
- It is a known endemic disease but is occurring in such a fulminant outbreak form (far beyond the severity expected) that an emergency response is required to ensure that there is not a large-scale epidemic of national significance or serious loss of market access.

EADs for the poultry industry include avian influenza (AI), very virulent infectious bursal disease (vvIBDV) and Newcastle disease (ND), which can cause devastating impacts to a poultry farming operation and the industry. Occurrence of these diseases is unusual, and can be devastating to a business, region and/or industry.

## 2.3 Endemic disease

An endemic disease is one that belongs exclusively to, or is confined to, a particular location. In the context of poultry diseases, this means any disease that is known to occur, and recur, in Australian poultry flocks. Endemic disease includes Marek's disease (MD), infectious bronchitis virus (IBV), avian encephalomyelitis (AE), Egg Drop Syndrome (EDS), *Mycoplasma gallisepticum*, infectious laryngotracheitis (ILT), etc. These diseases are more likely to occur on Australian eggs farms and biosecurity should prioritise the exclusion of these diseases. Biosecurity practices that exclude endemic diseases (other than vaccination) are also expected to significantly reduce the risk of emergency disease occurrence.

## 2.4 Human foodborne illness

A major reputational and public health issue for the egg industry is the presence of *Salmonella* spp. (particularly some *S. Typhimurium* serotypes), which can cause salmonellosis in humans throughout the supply chain. The presence and spread of *Salmonella* depends on numerous variables, so there is no single effective control measure. However, biosecurity practices that reduce the incidence of endemic diseases are also considered to significantly reduce the incidence of foodborne pathogens associated with eggs. While transfer of antimicrobial resistant bacteria is considered a low risk in Australian egg production, it is still important to note the biosecurity principles that can reduce the risk of antimicrobial resistant bacterial transfers.

# 3 Principles of risk

## 3.1 Objective of risk identification

This report is designed to help Australian egg producers identify biosecurity risks in their operation, understand why these are biosecurity risks, and provide an indication of how to improve the management associated with the risks. More specifically, this report identifies risks associated with the transfer of disease agents:

- to poultry associated with horizontal contact
- from an infected area to an uninfected area, and
- to humans.

This report provides producers a guide to:

- identifying biosecurity risks
- determining why each is considered a biosecurity risk, and
- some potential options available to reduce each risk.

*This document is NOT intended to provide a complete risk assessment and risk control framework, as these are specific to each operation and should not be generalised.*

## 3.2 Industry scope

There are three egg production systems in Australia: cage, barn and free range. Organic egg production is a niche segment within free range. The risks associated with each production system are based on the same premise – minimising the potential for pathogen incursion to the Flock, although prioritisation and management of the risks will vary.

## 3.3 Pathogen scope

Biosecurity is the prevention and control of the transfer of pathogens that cause disease to humans or animals, and good biosecurity should not discriminate between a human pathogen (e.g. *Salmonella*) and pathogens that cause disease in poultry. Occurrence of any of these pathogens on an egg farm can have serious, negative economic consequences.

Pathogens include:

- viruses, such as endemic (MDV, ILT, EDS, AE, IBV) and emergency (NDV, HPAIV, vvIBDV)
- bacteria that affect poultry (e.g. Mycoplasma, *Pasteurella* and *Campylobacter hepaticus,* the cause of Spotty Liver Disease) and pathogenic bacteria that affect humans (*e.g. Salmonella*)
- protozoa, such as coccidia (e.g. *Eimeria* spp.), and
- internal and external parasites.

## 3.4 Special considerations for layer industry

While general biosecurity risks for poultry operations apply (in principle) to layer farms, there are some specific considerations for risks that relate to operations that house layer hens:

- most layer farms are multi-age, and some farms have multi-age sheds (particularly cage)
- some layer farms may have rearing and production, grading floor and feed mill on the same

property, are within the same region, or a combination thereof
- movement of the same personnel between different sectors of the farming operation, and
- some layer farms are mixed enterprises, with free range, barn and cage operations.

The site manager (who is often the owner) has ultimate responsibility for the management of all vehicle and personnel access, stock and feed movement, and direct contact of the Property to other enterprises. The manager is also responsible for setting the 'biosecurity culture' for a farming operation, which impacts directly on the attitude of the staff to biosecurity, as well as the attitude of those visiting the farm. The manager is also responsible for monitoring staff and visitor compliance with the biosecurity risk management procedures that are in place.

## 3.5 Biosecurity risk management (risk vs impact)

This report is designed to inform an on-farm risk assessment for Australian egg producers. Identifying areas of risk is the first step to building a farms' risk management plan. Each hazard (area of risk) that is identified as being relevant to an operation should be assessed for its 'risk' vs 'impact'.

Risk refers to the likelihood that a hazard (or 'area of risk') would cause an 'impact' on production or animal welfare. Procedures, contacts and features that could lead to the transfer of pathogens to the Flock are all areas of risk. However, the likelihood of a risk occurring doesn't necessarily affect the impact that it is going to have on the Flock/production – e.g. there may be a high risk that a subclinical infection will occur, but the impact on the Flock would be minimal. Conversely, there may be a low risk that a foreign pathogen will enter Australia and affect a Flock, but the impact would be disastrous if it occurred.

For example, an identified risk may be 'untreated surface water supplied to the hens'. The 'likelihood' is how likely, or probable, it is that this situation may present a risk to the hens (and by extension, the farm business), and untreated surface water supplied to the hens has a 'high' likelihood of providing pathogen transfer to the hens. The impact, or consequence, of this situation can then be determined based on varying perspectives. The worst-case scenario in this instance is potentially '*transfer of an emergency animal disease to the hens that could lead to complete depopulation of all stock followed by downtime on the farm',* with the most likely scenario being '*lost productivity, markets and increased costs associated with disease investigation, control, and prevention for next flocks'*. How this risk is managed depends on each individual situation and the producer's individual appetite for risk (i.e. how much risk they are willing to operate with). For EAD's, producers have a (legal) responsibility to the egg laying industry to ensure their biosecurity practices are applied and risk minimisation optimised.

# 4 Resources – technical manuals and posters

Australian Eggs (formerly known as AECL) together with Animal Health Australia has recently published two key documents on biosecurity for the egg industry:

1. *National Farm Biosecurity Technical Manual for Egg Production* (April 2015). This is available at: https://www.farmbiosecurity.com.au/wp-content/uploads/2019/03/National-Farm-Biosecurity-Technical-Manual-for-Egg-Production1.pdf
2. *Code of practice for biosecurity in the egg Industry – Second Edition* (Jan 2015). This is available for download as a PDF at: https://www.australianeggs.org.au/what-we-do/leading-research/biosecurity-in-the-egg-industry/

Other materials include:

- Biosecurity posters (https://www.australianeggs.org.au/what-we-do/leading-research/biosecurity-in-the-egg-industry/)
- *Salmonella* posters (https://www.australianeggs.org.au/what-we-do/leading-research/through-chain-salmonella-risk-identification/)
- Farm biosecurity videos and toolkits (http://www.farmbiosecurity.com.au)
- Australian Eggs Annual Report, 2017. (https://www.australianeggs.org.au/who-we-are/annual-reports/#item-818)

# 5 The Property – biosecurity risk identification

## 5.1 Scope and overview

### 5.1.1 What is the 'Property'?

The Property is the area defined by a boundary that encompasses all buildings that house poultry, farm business buildings (e.g. office), people that come into contact with poultry, water and feed storage, vehicle movement to/from and on/off the farm, equipment storage, cleaning and chemical equipment, out-buildings, and roads that service vehicle movement between buildings.

The Property is the buffer zone that provides a secure perimeter and separates the Production Areas that house poultry from potential incursions and biosecurity breaches. It is the primary control zone for producers to restrict pathogen transfer, prevent disease infection of their flocks and is the buffer zone that keeps unwanted pathogens away from the Production Area and the Flock. The Property should be clearly marked on a map, including all access points, and form part of the site Biosecurity Management Plan. The Property zone should be physically defined by a stock-proof fence, with lockable access gates on all vehicle entry/exit points. There should be signage advising all entering the Property that it is a 'biosecurity area' and that there are strict access controls in place, with contact details on how to reach the manager. There should also be a log book within the Property at the entrance of the Production Area to record entry to the Production Area and other pre-visit movement details, including a quarantine declaration. Some Properties are expansive and may have multiple 'Production Areas', and each of these must be adequately fenced to clearly emphasise production units and the Biosecurity Production Area. Action must also be taken to reduce the biosecurity risk of unwanted animals entering the Production Area (including rodents and wild animals).

### 5.1.2 What are 'Property' biosecurity risks?

*Property biosecurity risks are those that are related to the movement of pathogens from outside the Property onto the Property, either carried on/in vehicles, wild animals, personnel and equipment.*

There are many options available for managing the transfer of pathogens onto a Property, although not all may be practical or viable for each operation. For example, a vehicle and/or wheel wash could be located at the primary access point with appropriate disinfectants, fresh clean water, washing equipment and drainage, but may not be feasible on smaller Properties.

Pre-visit requirements should be established by the manager, which are to be abided by all personnel and visitors entering the Property to limit the potential transfer of pathogens onto the Property via clothes, hair, boots, vehicles and equipment, etc.

A manager should question whether a person really needs to enter the farm, and if so, they must determine what risks they pose to the site, and any proactive measurements required. These requirements could include clean boots, or property-only boots to be worn while on-site, clean clothes and/or disposable coveralls to be worn, and where to store items such as mobile phones and other personal items (that may not be allowed to be brought onto the farm). Other options include methods to disinfect equipment or sanitise personal items.

Pre-visit quarantine is a pre-determined period of time that a person who has been in contact with other poultry, avian species, poultry product (eggs, abattoir and poultry waste) must wait before being permitted entry to the Property. This may also extend to include other livestock, which may contain

pathogens that can be transferred to poultry. This principle should also be applied to equipment and vehicles that enter the property.

The severity of biosecurity risks to a Property may change over time, so potential risks should be identified and assessed for varying management options as new information becomes available, or the risk becomes more likely (e.g. a disease outbreak on neighbouring farms).

## 5.2 Biosecurity risk identification Section 1 – the Property

**Table 1 Areas of risk identified on a Property**

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| Farm Biosecurity Plans | Each farm should have a Biosecurity Plan, developed and maintained by management, to clearly define zones and procedures for all staff to prevent, or reduce, a biosecurity incident. | If operations and procedures are not clearly defined, and staff are not properly trained in these procedures, there is a higher risk that a biosecurity incident will occur due to human error. | • Each Property should have a Farm Biosecurity Plan that outlines the biosecurity risks and their management options, and recommendations specific to that farm. The information for that plan can be drawn from several resources, including the National Farm Technical Biosecurity Manual for Egg Production.<br>• This plan should be reviewed regularly to ensure risk management is adequate, particularly when operations on the Property change (e.g. increased production; new processes to manage waste disposal; change from caged production to free range). |
| Proximity to water bodies that may house waterfowl | Surface water, including rivers, creeks and dams are the natural reservoirs of critically important avian pathogens, such as AI virus, and can be frequented by waterfowl.<br>If unsecure water is used in the Production Area for drinking, cooling, and amenity use, this could introduce significant avian pathogens. | The ability to control waterfowl on larger dams or rivers has limitations, and thus the water should be considered as having a high risk of contamination at any time. Waterfowl may frequent the Property range and amenity contact areas, which will increase the risk of pathogen transfer.<br>The size and location of water bodies has a direct impact on the number and types of waterfowl that may enter and reside on the Property (even puddles on the range or around the perimeter of sheds can pose a risk).<br>The green vegetation around surface water or around the perimeter of the sheds and range can act as an attractant for waterfowl, particularly during dry periods.<br>Water is a critical resource on farms, however, it should not be situated near the sheds or within the Production Area unless mandated by planning and environmental authorities.<br>Seasonal flooding may inundate low-lying areas adjacent to sheds and maintain water for longer periods, which may attract waterfowl. | • Consider options for alternative water sources that may be at a lower risk of being infected with pathogens that may cause disease in the poultry.<br>• Where surface water must be used, it should be effectively treated, including filtration and disinfection, with sufficient contact time to ensure pathogen destruction in accordance with the National Water Biosecurity Manual – Farm Biosecurity.<br>• Treated water should be tested regularly (even up to several times a week) and recorded.<br>• The treated water should be held in sealed tanks prior to supply to the sheds for drinking, cooling or cleaning.<br>• The operational aspects of treatment systems should be assessed regularly (e.g. twice every year).<br>• The water treatment plant should be able to cope with higher organic loads that can occur after rainfall, to ensure effective filtration and disinfection.<br>• Attracters of waterfowl on the Property and Production Area should be reduced.<br>• Remove dams where possible and locate remotely from Production Areas. Any surface water (e.g. creeks, rivers, |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | | dams) within the Property could be filled in and/or fenced off from the Production Area.<br>• Consider options that limit the ability of ducks to land on dams. |
| Terrain | Respiratory pathogens can travel further along valleys than over ridgeways, which increases the risk of airborne transmission along a valley. Flooding or pooling of water increases the risk of contaminated water coming into contact with the poultry. | The terrain surrounding a Property can influence the prevailing wind direction and likelihood of water pooling in the Production (and/or Range) Areas and can therefore increase the risk of airborne pathogen transmission down a valley, compared to over a ridge or via direct contact in infected water. | • Consider options for reducing transfer of dust and wind from high risk directions (e.g. location of other farms).<br>• Planting trees along the prevailing wind boundary can increase air turbulence and reduce pathogen concentration in the air that reaches the farm. |
| Climate | Climate can increase the risk of greater pathogen transfer via wind and water (e.g. flooding). | Airborne pathogen survival rates are directly correlated with the transmission distance and increase the risk of pathogen transfer between farms. There is a known correlation between prevailing winds and the risk of pathogen transfer due to cool/moist or dry climates. | • The strategic location of farm sites and buffer distances from other poultry farms can assist in mitigating biosecurity risks.<br>• Planting trees along the prevailing wind boundary can assist in controlling the movement of airborne pathogens. |
| Vegetation | Vegetation can be a refuge for wildlife that can be carriers of pathogens and potentially increase the risk of disease transmission to the Flock. Vegetation may also impact on wind movement, which can increase the risk of pathogen transfer between neighbouring Properties. | Wild birds and animals will nest and live in vegetation and there are many examples of them transferring pathogens to poultry.<br>Waterfowl tend to land on open water and congregate. They then venture up the banks to graze on grass and are attracted to the vegetated and green grass range of poultry farms, and are considered to have contributed to AI outbreaks in the past. | • In general, tall dense vegetation between farms may assist in decreasing the risk of pathogen transfer between Properties.<br>• Taller trees create good buffers, disrupt wind flow, and may assist in decreasing the risk of pathogen transfer, as well as odour and dust dispersion.<br>• These options need to be managed alongside the risk posed by wild birds and animals nesting and living in these trees and buffers. |
| Geography | Wild birds can be carriers of pathogens, such as AI. The risk of AI has been linked to wild-waterfowl movements and indirect or direct horizontal contact with commercial poultry. | Farms in certain locations should be aware that they may be at greater risk of EAD incursion due to the geographical location of the farm in relation to waterfowl populations. For example, the area from South-East Queensland to Victoria is seen as a part of Australia at higher risk due to waterfowl breeding season, climate and waterfowl movements. Fortunately, waterfowl movement monitoring studies have shown that Australia is not influenced by international migrating of waterfowl that are high risk species (Order Anseriformes). The endemic populations of these waterfowl have very low infection rates with endemic-type influenza viruses. Other species that migrate internationally, such as waders (Order | • Farm managers should be aware of the types of wild birds that fly over or inhabit the region where their Property is located.<br>• This includes becoming aware of higher risk seasons and times of the year (e.g. waterfowl breeding season).<br>• Options for managing wild birds are limited, but awareness of wild bird movements may provide an insight into appropriate risk management strategies and deterrents. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | Charadriiformes), are considered low risk species. Biosecurity risks are therefore much greater with larger water bodies that attract waterfowl on, or near, the Property, and not migratory paths. | |
| Proximity to roadways | Regarding the transport of poultry along a roadway, open vehicles may allow feathers, dust, faecal material and pathogens to potentially disseminate into the immediate environment, posing a pathogen transfer risk directly related to the proximity of a poultry farm to the roadway. | Not all pathogens transmit well via wind.<br>Pathogen transfer risk is directly related to the size of the populations, in terms of both the source of the pathogen and the susceptible flock. The larger the population, the greater the concentration of material released. A truck carrying a load of poultry moving along a roadway that passes a farm situated close to the road increases several potential risks. Firstly, if the farm has a large population of poultry that has an airborne pathogen (e.g. Mycoplasma) and the truck is carrying day-old chicks from the hatchery, or pullets from the rearing farm to a layer farm, the birds on the truck could become infected. Alternatively, if the truck is carrying a relatively small number of spent hens to processing and these are infected with a respiratory pathogen, they could transmit to poultry that is housed on a farm in close proximity to the road.<br>Pathogens emitted from moving vehicles generally survive shorter periods in the day time compared to night due to ultraviolet light during daylight hours. | • Tree buffers could be planted along the perimeter fence, or elevated earth banks constructed.<br>• The Property design should include consideration for the distance of all sheds from the main roadways.<br>• Farm management should develop an understanding of poultry farms in the area and where these farms process their products, and thus gain an understanding of the types and frequency of poultry movement along the nearest roadway.<br>• Farm management could seek cooperation from adjacent properties or processors to move stock via different routes. |
| Vehicles: General | Any vehicles entering a Property may have unknowingly been in contact with pathogens on another farm, which can potentially transmit disease between farms. When there is direct or indirect contact of vehicles entering the Property with unknown pathogens during a disease outbreak, quarantine restrictions may be imposed on the farm and, depending on the pathogen, potential depopulation of the Flock can occur, which could have a catastrophic impact on business. | Pathogens, such as bacteria, viruses and insects, have been shown to travel from one farm/site to another on vehicles.<br>Examples include: AI transmission via waste disposal, egg transport and dead bird pick-up vehicles; and Infectious Laryngotracheitis transfer via feed transport and spent hen pick-up vehicles. Vehicles entering the site that may move between other properties and carry pathogens include feed transport, gas, litter, chick supply, pullet supply, spent hen removal, egg transport, dead hen removal, manure removal, litter supply and removal, packaging and other suppliers.<br>Both the outside and inside of a vehicle represent a risk of pathogen transfer. | • Where possible, management should be aware of all vehicles coming to the Property (through a vehicle log) and stipulate the pre-visit quarantine requirements prior to arrival. Where possible, the manager should consider biosecurity risks associated with each vehicle type (e.g. trucks, cars).<br>• Prior to allowing entry to the Property, the risk of pathogen transfer from vehicles could be managed by the effective washing and disinfecting of all vehicles at the farm perimeter, especially around the wheels.<br>• Effective washing and disinfection can also be performed off-site at a dedicated truck wash and the wheels can be disinfected at the farm gate. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | It is difficult to effectively disinfect the inside of a vehicle, however, vehicle footwells should be kept cleaned and the cabin should be free of insects when moving between farms. For most farms, it is not practical to effectively wash and disinfect the outside of larger vehicles, although this should be managed according to frequency of visitation and risk. | • The nature and status of the material being transported should be known, with consideration given to ensure traceability in the event of a change in disease status.<br>• Automated vehicle washes can be set up, that spray over the entire outside of the vehicle. Manual vehicle washes can also be set up, with a hose connected to a venturi spray and drum of disinfectant operated by the driver or farm personnel. |
| Vehicles: Stock Placement | The hatchery and hatchery vehicles can be a potential contact point with other farms, particularly if using a transport contractor that works across multiple poultry industries. | Hatchery vehicles may have been to another farm prior to delivery, and potentially had direct contact with another vehicle where chicks may be transferred. Thus, the hatchery vehicle can be a source of pathogen transfer. | • The hatchery vehicle should be cleaned and disinfected prior to loading, and evidence should be requested to prove that this has occurred.<br>• Identify how many other farms (and which) the truck had visited immediately prior to delivery.<br>• The pre-loading cleaning program, route from hatchery to farm, and review of any other deliveries or contact points should be screened prior to entry.<br>• The wheels could be washed upon arrival, prior to unloading.<br>• Farm staff should take the trolleys into the shed for unloading and return them to the driver who should not enter the shed.<br>• Vehicles used for pullet transfer and spent hen depopulation should be thoroughly cleaned and disinfected between use (including crates). |
| Vehicles: Stock Transfer Crates | Pullet transfer crates come into direct contact with the Flock and can be one of the greatest risks for pathogen transfer to a poultry farm. | Pullet transfer is often performed by contractors who visit multiple farms. Pullet transport crates may not have been cleaned properly after being used to move hens on another farm.<br>The vehicles and transfer crates can be a source of pathogen transfer and need to be thoroughly cleaned and disinfected prior to loading with stock and transporting to, and entering, the Property. | • When possible, each farm should have its own pullet transfer crates, which should be cleaned, disinfected and inspected by management prior to, and after, use.<br>• When this is not possible, ensure the pullet transport contractor thoroughly cleans and disinfects their transport cages/crates, trailer and vehicle prior to arrival.<br>• When the same crates are used for pullet transfer and depopulation, it is essential that they are thoroughly cleaned, disinfected and inspected by management.<br>• The manager should obtain a completed cleaning record prior to allowing vehicle entry to the Property (ideally, the day prior to arrival). The crates should be inspected at the Property perimeter and if not deemed to meet a satisfactory standard, they should be re-washed and |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | | disinfected prior to allowing them into the Production Area. |
| Vehicles: Stock Depopulation Crates | Vehicles and crates used for transporting spent hens to the abattoir (or elsewhere) will have been in contact with other poultry, including spent hens from other farms and could have, therefore, been in contact with pathogens or external parasites, such as red mites. | Modules with crates are usually unloaded and taken into sheds or positioned immediately within the vicinity of the shed to load hens. If not adequately cleaned and disinfected, these can transfer organisms onto the Property. The highest risk situation is considered to be if some hens remain in the shed (partial depopulation), which could allow any pathogen introduced to amplify and spread across the Property. This risk is considered higher within multi-age sheds. | • The manager should request evidence that vehicles and crates have been cleaned and disinfected.<br>• Evidence of whether stock depopulation vehicles have visited other properties within the previous 48 hours should be obtained.<br>• Ensure all hens are removed from the shed as quickly as possible for single-aged sheds.<br>• For multi-age sheds, it is imperative that partial depopulations are done with crews, modules and crates and vehicles that have undergone sanitary procedures that will minimise any risk of the transfer of an avian pathogen.<br>• When the same crates are used for depopulation and pullet transfer, it is essential that they are thoroughly cleaned, disinfected and inspected by management. |
| Vehicles: Egg Transport | Transport vehicles often travel between multiple farms, and carry eggs and fillers between Properties, all of which can harbour pathogens. The truck, eggs and egg fillers and pallets represent a high risk of pathogen transfer to the Property. | Eggs are often packed in egg fillers onto pallets on trucks, which may be unloaded within the Production Area if there is a need to retrieve packaging or trolleys from further up the trailer. This movement may transfer pathogens to the Property.<br>Due to the time it can take before a pathogen causes disease, every horizontal contact should be treated as potentially contaminated and controls put in place to minimise the risk of pathogen transfer. For example, AI virus transfer is suspected to occur by an egg transport vehicle that stopped to collect eggs from one farm before picking up eggs from another, prior to the first farm becoming aware that it was infected with AI.<br>Eggs, egg fillers and pallets returning from farms may transfer pathogens to the grading floor and should be quarantined and washed/disinfected when possible. | • The manager should request evidence that vehicles and crates have been cleaned and disinfected.<br>• The manager should request evidence of whether the previous Property was known to be infected with a pathogen.<br>• Only clean packaging should be allowed onto the Property.<br>• A designated pick-up area for the vehicle to dock and load/ unload should be provided.<br>• Where possible, another farm's eggs should not be unloaded on the Property.<br>• If eggs are being supplied from one Property to a grading floor on another Property, the pallet of eggs could be supplied covered and stored in a demarcated quarantine area of the cool room.<br>• All equipment and materials should be cleaned and disinfected after processing eggs. When eggs are obtained from a known high-risk site, then it must be ensured that all contact handling and transport material and equipment is cleaned and disinfected before reuse elsewhere. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | | Optimally, this material should be designated for use only on the high-risk site.<br>• Pallet jacks should be clean before use, and if using the farm's forklift, pallet jack or egg trollies to move eggs between the Production Area and the grading floor, the wheels and forks should be cleaned and disinfected prior to allowing the vehicle to return to the Production Area.<br>• Egg transport truck drivers should not enter the Production Area and remain within the vicinity of their truck, wearing protective footwear. |
| People movement | People can carry pathogens on their clothing, on their hands and in their hair, and even in their upper respiratory tract. | Movement of people in and out of the Property can transfer pathogens and so biosecurity programs should target all areas of personnel movement on and off the Property. | • All risks associated with people movement can be managed with good biosecurity procedures, training, and facility design.<br>• There should be various personnel and visitor entry controls, clear and well-placed signage at all entry/exit points advising people of the biosecurity zone they are entering. Signage should outline the procedures that must be followed, restricted areas of access that require approval, and management contact details. |
| People movement: Staff | Staff are the most frequent form of human contact on the Property.<br>Staff can move frequently between flocks of different age, health status, and farming system (cage and free range), which represents a significant risk of pathogen transfer. | From a positive perspective, staff tend not to visit other Properties, but rather travel between their home and work. Therefore, the highest risks are staff who have independent contact outside of work with other avian species or pigs, or who visit other egg production Properties. Staff returning from high-risk, overseas countries and/or experiencing gastrointestinal signs on return to Australia are considered a high risk. | • Staff should be trained in the biosecurity procedures specific to that Property (with training documented and renewed regularly) and understand the risks of being a potential active or passive carrier of pathogens to the Property. Staff should be made aware of the importance of biosecurity on Flock performance, human health and enterprise viability if there was a disease outbreak (particularly an EAD).<br>• All staff should feel part of the culture that maintains the biosecurity program, feel comfortable to raise any concerns or deviations with management, and provide feedback on how the procedures could be improved.<br>• A strict biosecurity compliance clause should be part of each staff member's employment contract, and consequences for breaching this need to be clearly outlined. This should include a declaration that they will not keep poultry at home, or visit avian species, pet shops or other domestic livestock prior to coming to work within the specified pre-visit quarantine period. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | | • Staff should be encouraged to remain in their dedicated work area and not cross to other work areas without first changing their boots and clothes.<br>• Staff should be encouraged to declare when they are suffering from gastroenteritis or flu-like signs, and options should be put in place for preventing potential transfer of pathogens onto the Property (e.g. not being allowed access to the Property and discouraged from coming to work until after a prescribed period or clearance from a medical practitioner).<br>• For high valued breeding stock personnel, *Salmonella* testing is a consideration. |
| People movement: Visitors (including delivery truck drivers, suppliers and other visitors) | Visitor footwear and clothing can carry pathogens onto the Property. Even if visitors stay outside the Production Area, there is still a risk of pathogen transfer to farm staff, which could lead to infection of the Flock. | Visitors who are suffering from gastroenteritis, human influenza, or who have recently travelled internationally can transfer pathogens onto the Property. They may also not have the same understanding of biosecurity as staff and are less likely to be aware of the risk they pose to the Property.<br>For example, delivery vehicle drivers usually move from farm-to-farm within each day and must leave their vehicle to connect delivery tubing between the truck and the silo, or truck and tank. Drivers tend not to change boots or put on external clothing when they enter the Property, and the silos/tanks are invariably situated immediately adjacent to the Production Area. Farm staff who venture into the delivery zone can create a contact point for pathogen transfer, so it is vital that there are controls around delivery vehicle driver movements before coming to, and entering, the Property. | • All visitors should contact the manager prior to the visit to schedule a time, and the manager should confirm that the visitor meets the pre-visit quarantine period (down-time) prior to coming to the Property.<br>• When visitors arrive, only those who meet the pre-visit quarantine should be allowed to enter the Property.<br>• Any visitors with gastroenteritis or flu-like signs should not be allowed access to the Property.<br>• Pre-visit quarantine requirements (e.g. do not own any poultry at home) should be communicated, and visits scheduled accordingly.<br>• Once at the site, visitors should be advised by the manager of areas they can access, and complete all documentation associated with their biosecurity status.<br>• Visitors who have, by necessity, visited other Properties on the same day (e.g. delivery vehicle drivers) present an additional risk and should put on clean shoe covers and overalls and apply a hand disinfectant prior to touching any equipment, vehicles or machinery on the Property. |
| People Movement: Suppliers, service personnel and customers | Product suppliers can have contact points with other poultry producers and represent a biosecurity risk. Examples include the feed supplier, waste disposal, suppliers of egg handling equipment, auditors, regulators and veterinary health services. | Suppliers and customers represent a risk of farm-to-farm pathogen transfer. Contact with these companies, organisations and individuals should be appropriately managed to reduce the risk of pathogen transfer to the Production Area. | • Farm management should review each contact point with routine suppliers and customers, and set rules for the pre-visit quarantine of personnel and vehicles.<br>• Farm gate egg sales should be avoided when possible, or eggs should be transferred to a separate area outside the |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | | Property to prevent direct and indirect contact with visitors. |
| People Movement: Sales representatives | Sales personnel move from farm to farm and usually meet on-site, which could cause pathogen transmission between farms. | Sales representatives are focused on meeting as many customers as possible, as efficiently as possible. | • Sales personnel should not enter the Production Areas.<br>• Farm management should stipulate the minimum quarantine requirements to sales personnel before entering the Property. These may include, specifying contact periods between farm visits, asking sales representatives to prioritise their visit to the farm, wear different shoes or spray them with an aerosol disinfectant prior to visiting, and only meet staff at the perimeter of the Property Area, unless a sufficient quarantine period can be proven. In some situations, the best risk management option may be to meet them off-site.<br>• The Property should be structured with facilities that allow routine contact with visitors only at the office, which should be considered a 'dirty area'. |
| People movement: Personnel and visitors travel to high risk areas overseas | Staff or visitors returning from holidays or even transiting in countries or regions known to be dealing with disease outbreaks (e.g. South-East Asia) can develop gastroenteritis and potentially transfer these pathogens, or other specific poultry pathogens, to the Flock. | Parts of Asia have a high risk of exposure to food pathogens such as *Salmonella* Enteritidis, organisms with antibiotic resistance and virulent AI viruses. There is a risk that other travellers with whom personnel or visitors have come into contact may transfer pathogens, which may potentially transfer to the layers through other contact points, such as in the grading floor or liquid egg processing area. This is a known pathway for disease outbreaks. | • Farm management should consider quarantine policies for personnel and visitors who have been travelling overseas, which may include not only restrictions on the period of time from returning to Australia and entering the Property but should also include a risk assessment based on the countries visited, as some are considered a higher risk than others.<br>• Risk mitigation will include the knowledge of the overseas travel activity (e.g. conference vs farm visit), quarantine times, properties with shower access, nature of the work on the Property site, contact with livestock (office compared to farm worker), and worker health status on return.<br>• Consider options for managing staff members who develop an illness after travelling. |
| Signage | Clear signage is required to ensure procedure compliance by all personnel and visitors. | Without clearly outlined procedures, staff and visitors may decide on their own actions to take in a given situation, which can increase the risk of pathogen transfer between flocks.<br>Correct signage demonstrates the importance of biosecurity on the Property, and guides visitors to be cautious about what they do, where they go, and to | • Farm management should ensure that there is clear and effective signage relating to biosecurity at key control points around the Property. For example, at the farm entry gate, shed entry doors, grading floor entry door, and amenities block entry zone. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | raise concerns with management in order to help reduce risks. | • Signage should be simple, with minimal words, clear images, be readable at a distance and strategically located. Colour-coding can also be effective.<br>• Other written languages should be included where required. |
| On-site feed manufacturing | When feed is manufactured on the Property, there are multiple contact points (direct contact or indirect contact through pathways, such as aerosolisation) that could lead to pathogen transfer to the Property. Contact points can be associated with grain, other raw material and other horizontal contacts. There are also risks pertaining to storage areas that attract wildlife, rodents and invertebrates (insects) that may transfer pathogens to the Property and/or act as a reservoir of pathogens. | Some raw materials can increase risk when brought on-site, as they may be contaminated with pathogens, such as *Salmonella.*<br>When finished feed is sold to a third party, there is increased contact with other poultry and livestock farms that could return pathogens to the Property if vehicles and personnel movements are not securely managed.<br>Grain stores/spillage can attract wild birds and rodents if not properly managed, which can increase the risk of pathogen levels in the environment. These pathogens could potentially transfer around the Property, including to the Production Area, on personnel or equipment, and could even contaminate feed supplied to the Flock. | • On-site feed manufacturing should be isolated from the Production Area as much as feasibly possible.<br>• There should be strict staff movement controls, containment and separation of raw materials and finished feed, and active pest control programs (especially for wild birds and rodents). |
| Tools and equipment | Tools and equipment can be contaminated with pathogens via direct or indirect contact with fomites, air, or insects, which can then be transferred to the Property if not effectively cleaned and disinfected prior to entry. | Equipment that comes into contact directly or indirectly with poultry can transfer pathogens between farms. A good example is using the same bucket and hopper to load fresh shavings into a rearing shed that was also used to remove litter on another Property. Litter removal equipment can be difficult to clean, so a focused effort and good equipment must be used to complete this task effectively.<br>Equipment used to cull spent hens may be transferred between farms and should be cleaned effectively before allowing entry, even if going onto a Property where the hens are to be depopulated.<br>Tradespersons' tools can transmit pathogens between farms and should be addressed at the farm gate prior to entry onto the Property. | • A 'barrier of entry' of all tools and equipment to the Property could be implemented, which includes a control program to be activated preferably before the tools/equipment reach the Property.<br>• An inspection and disinfection process should be applied to the Property perimeter before allowing entry.<br>• When possible, avoid allowing entry of any equipment to the Production Area unless necessary. Look for on-farm solutions, or hire company equipment, e.g. have a set of tools and equipment that stay on-farm for visiting trades personnel to use.<br>• Every item should be assessed for the best disinfection technique. This may be as simple as a spray down of clean tools with a disinfectant, or 70% alcohol, or UV treatment. Sealable plastic bags can be provided for mobile phones, and a dunk tank or fumigation chamber can be used at the Property perimeter for larger, hard-to-treat items. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | | • Consider using a dedicated contractor who doesn't use their tools/equipment on any other poultry or livestock premises. |
| Supplies | Some materials cannot be effectively disinfected, such as cardboard fillers and wooden pallets. These can become contaminated at one farm, moved between farms, and taken onto the Property, which represents a high risk of pathogen transfer. | Materials sourced directly from another farm represent a high risk of pathogen transfer. | • Each material transferred onto the Property should be evaluated for biosecurity risks, and procedures should be customised to manage each risk.<br>• Only clean, unopened materials should be allowed onto the Property.<br>• When possible, evidence should be obtained by the manager that the materials are secure or have been disinfected or treated by an equivalent process.<br>• Materials should be maintained in their supplied wrapping during storage prior to use, preferably in the Property storage areas (rather than in the Production Area).<br>• When required, outer packaging could be disinfected prior to entry to the Property.<br>• Materials that must ultimately enter the Production Areas should be stored on the Property in bird and vermin-proof storage.<br>• Non-packaged materials, such as litter, could be stored in covered/protected areas on clean solid flooring away from any moisture, or unloaded directly onto a clean disinfected pad at the end of the shed then transferred directly to the shed. |
| On-site composting | Wastes, such as dead hens and used litter, can harbour pathogens. Composting these wastes on-farm can attract rodents, insects and wildlife, and cause pathogen transfer throughout the Property if not properly managed. | Composting takes time to complete efficiently and reduce the risk of pathogens, however, it can be an effective way to reduce risks if managed appropriately, otherwise composting can present a greater risk than the original dead hens/used litter. | • Compost sites should have a management plan that includes biosecurity risk management associated with personnel and equipment contact before returning to the farm.<br>• Wastes should be covered with fresh organic material soon after being deposited to help composting and reduce access. Secondary cover should then be applied (e.g. with a tarpaulin).<br>• Composting equipment should not be transferred between sites, and all equipment that transfers manure or dead hens between the Production Area and the Compost site should be appropriately washed and disinfected. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | | • Adequate rodent and wild-animal controls should be in place around the compost site to reduce the risk of spreading pathogens around the Property. |
| Egg fillers | Egg fillers, dividers and pallets can be a primary source of pathogen and parasite transfer between Properties. This can happen directly when fillers are repeatedly used, or indirectly when new fillers are transported between multiple farms on the same delivery equipment and vehicle. | Different types and uses of egg fillers represent different risks for a commercial layer operation. The highest risks are associated with reused cardboard fillers. The lowest risk is with new cardboard, or colour-coded washed and disinfected reusable plastic fillers. Farms should work toward reducing and managing this risk wherever possible, as there have been many examples of pathogen transfers associated with filler reuse between farms. | • Farm management should conduct a risk assessment of their filler type and reuse procedures.<br>• Ancillary equipment, such as pallets, modules, divider boards, etc., should be included in this risk assessment. |
| Grading eggs from other Properties | Handling eggs from other farms represents a risk of introducing pathogens to a Production Area. | Eggs, fillers and pallets represent an ideal pathway for pathogen transfer between farms. When eggs are transferred from one farm to another for grading, there is an inherent risk of pathogen transfer between farms. | • Farm management should conduct a risk assessment on how eggs from other farms are received, handled, stored, and processed – including breakages and waste management. There should be a focus on minimising any crossover points with farm staff and equipment in the grading floor that may return to the Flock.<br>• Eggs should be demarcated in a cool room so they are separated from the eggs produced on-site.<br>• Identification and traceability records of eggs should be in place.<br>• Plastic wrapping can be left on eggs transported on pallets and the exterior can be sprayed with disinfectant upon arrival and storage. Care should be made to avoid eggs sweating due to differential temperature changes.<br>• Cardboard fillers should be discarded without contacting the Flock and should not be taken into the Production Area unless there is clear traceability and the same site/shed is reused.<br>• Plastic fillers should be washed and disinfected prior to reuse.<br>• When possible, equipment should be cleaned after processing, wastes discarded, and the cool room and all contact points disinfected at the end of each day. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| B-Grade eggs and waste disposal from packing and grading floors | Eggs are a horizontal contact with Liquid Egg Processing (LEP) processing plants and waste, which includes reject eggs, eggshell and yolk debris and egg handling disposables that are potentially contaminated material.<br>These are high-risk biosecurity contact points and can lead to pathogen transfer to the Property if not managed carefully. | LEP plants take B-Grade eggs that are deemed not suitable as A-Grade shell eggs. This may include shell quality problems, dirties, cracked, smalls or eggs from high-risk, *Salmonella* positive flocks.<br>Commercial disposal of waste or on-site disposal in approved landfills are horizontal contact points that create a risk of cross-contamination. These contact points require a barrier between the Property and the waste removal. | • Farm management should conduct a risk assessment of egg disposal methods and potential risk of pathogen transfer to the Property, and how this risk should be managed.<br>• Packaging materials used to send eggs to waste disposal centres should not be recycled and contact points should be managed, including segregation and disinfection, before returning any materials to the grading floor. |
| Proximity to other farms | Apart from movement of pathogens on vehicles, personnel and equipment, pathogens can transmit between sites within a region due to the movement of rodents, insects, dust/fomites and by airborne means. | Pathogens can transmit from different types of farms, particularly chicken to chicken, but also other types of avian species, such as ratites. Pathogens can also be transferred from other animal species. For example, the same *Pasteurella* type has been isolated from dead pigs and dead chickens on adjacent farms.<br>Transfer can be via horizontal contact from airborne spread, surface water run-off, or rodents and insects between adjacent properties. It is difficult to control airborne pathogen transfer from nearby poultry farms.<br>Rodents represent a risk of pathogen transfer between properties, particularly during crop harvest and the onset of cooler weather. Greater buffer distances reduce the risk of rodents or insects entering the Property carrying pathogens from another farm, or dust transferring pathogens between Properties. | • Adequate buffer zones from other poultry farms should be considered during planning.<br>• Once a Property has been established, control options include: planting trees on perimeter fencing; rodent control programs; construction of elevated earth banks; and the minimisation of equipment and vehicle movement between neighbouring Properties.<br>• Owners of the Property can take a regional approach with their neighbour and discuss dead animal disposal sites, water run-off, and dam management procedures. |
| Pest activity: wild bird, rodent, wild animal and insect movement | Wild birds, rodents, wildlife (e.g. kangaroos), and vermin (e.g. foxes, cats and wild pigs), can be a source of pathogens, such as *Salmonella* spp.<br>Foxes are not considered a high risk of pathogen transfer, although their presence can lead to mortalities by primary intervention and smothers, or secondary flight and fright behaviour. These stresses can evoke diseases such as spotty liver disease. | Poultry farms represent a highly attractive environment for rodents, wildlife and other vermin due to the presence of open water, grass, exposed feed/grain around silos, and manure. Poor Property design, such as long grass, open water, open shelters/sheds, lack of fencing, on-farm manure storage, together with a lack of grounds maintenance, encourages pest activity in larger numbers. | • The Property should be fenced with mesh that is high enough to prevent wildlife movement. The fence design to control the ingress of foxes is more complex as it involves a high fence, with overhangs, buried base wire and possible electrification.<br>• Shed perimeters should be free of long grass and debris and have an active rodent and insect bait station program in place. Manure and dead birds should be stored securely and not on-site in open areas.<br>• Bait stations should be monitored monthly (or more frequently), and increased rodent activity and the chemicals used should be routinely evaluated to optimise efficacy. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
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| | | | • There should be a rodent bait station map, with each station individually numbered and any activity recorded.<br>• Rodent bait studies should not be spatially, uniformly positioned but arranged in a layout and frequency that coincides with rodent tracking activity and primary locations. |
| Other livestock/animals | Livestock, such as sheep and cattle, can be a source of pathogens (e.g. *Salmonella*).<br>This risk can also apply to domesticated animals, and those housed on-site as protection for the hens. | Livestock tend to gather on the pedestrian paths, roads and around buildings and their faeces can easily contaminate personnel, vehicles and equipment that enter the Property and its perimeter. | • When possible, avoid livestock access inside the Property.<br>• Mow grass on the Property and in the Production Area (avoid grazing where possible).<br>• If stock/animals are allowed to enter dedicated and controlled access zones on the Property, they should be tested for pathogens that might cause disease in humans or poultry prior to entry. |
| Record keeping | Accurate record keeping is essential for highly effective biosecurity risk management. | Without accurate record keeping of all production parameters, people, vehicle and equipment movements, it may not be possible to determine when a problem arises, if procedures are being followed, or to identify key risk areas. Record keeping also helps to protect operations by providing active biosecurity risk management. | • Appropriate records should be established for staff to complete in all areas of operations that relate to biosecurity, including flock performance, people, vehicle and equipment movement. |
| Training | Without training it is difficult to ensure standardisation of procedures, and this can increase biosecurity risks. | Training is the best way to standardise procedures and provide staff with accountability for biosecurity risk management on the Property. | • Regular training (or refresher courses) should be conducted with all farm personnel, ideally based on the Property's Farm Biosecurity Plan.<br>• Ideally, the training (or refresher courses) should outline the prioritisation of biosecurity within the operation and the culture established by the manager.<br>• Training (or refresher courses) should be recorded as documented evidence that staff are kept up-to-date with their biosecurity responsibilities. |

# 6 The Production Area – biosecurity risk identification

## 6.1 Scope and overview

### 6.1.1 What is 'the Production Area'?

*The Production Area encompasses all buildings that house poultry, any range areas that poultry directly access, egg grading areas connected directly to the poultry sheds, personnel areas that directly come into contact with poultry, water and feed storage areas that directly connect to the shed. This includes ventilation, shed entry points that have contact with personnel, vehicles and equipment. It may also include an on-site feed mill for smaller operations.*

Controlling biosecurity risks at the boundary of a Production Area constitutes the most critically important biosecurity protection zone that a manager and farm staff should prioritise. The Production Area zone should be clearly marked on a site map, including all shed and range access points, and be clearly presented in the site's Biosecurity Management Plan. The Production Area should be physically defined by control access doors/gates that can be locked. The Production Area and Property boundary may be the same in some instances, however, where possible, there should be a separate perimeter fence that restricts movement and clearly defines the Property boundary, including all aspects of the Production Area.

### 6.1.2 What are 'Production Area' biosecurity risks?

*The Production Area is the control point for personnel, equipment, vehicle, water, feed, bedding and air supplied directly to the Flock.*

While the biosecurity control procedures at the Property level are designed to minimise the transfer of pathogens onto the farm, there are additional risks that occur in the Production Area. These risks include: on-site exposure to wild birds; on-site flocks of different age; rodents; other wild animals (that can carry *Salmonella*); or a truck driver who has delivered to another farm on the same day. Management of the risks in the Production Area is secondary to risks associated with direct contact with the Flock. The key to efficiently managing the biosecurity risks of the Production Area is to build biosecurity into the farm design and Standard Operating Procedures (SOPs).

The manager should adopt a risk assessment-based approach to evaluating any new risk or change in status before allowing the process to progress, especially if that process involves people, vehicles, or equipment entering the Production Area, as this is the final control point before direct contact with the Flock.

As with Property risks, some options for the management of Production Area risks may be more viable than others, which depends on farm and manager-specific characteristics. The viability of managing a risk should not undermine the seriousness of that risk.

## 6.2 Biosecurity risk identification Section 2 – the Production Area

**Table 2 Areas of risk identified in the Production Area**

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| Vehicles: General | Vehicles that enter the Production Area can carry pathogens on their wheels, on and under the vehicle, within the truck body, and within the driver's cabin. | Vehicles entering the Production Area should be screened and controlled to prevent the transfer of pathogens onto the site. | • Vehicles and drivers should not be allowed access to the Production Area unless necessary.<br>• Pre-visit quarantine controls should be applied where possible.<br>• Specific vehicle entry points to the Production Area should be marked.<br>• Property design and operation should be facilitated to allow off-site delivery of materials that are normally trucked. This includes feed, gas, waste collection and product interchange. |
| Vehicles: Egg transport | Egg transport vehicles can enter the Production Area and may drop off eggs or packaging from another farm, which can increase the risk of transferring pathogens between farms. | Egg transport vehicles and personnel are a key risk for poultry farms, as they come into direct contact with the packing floor or cool room in the Production Area. This can be an indirect source of pathogens to the Flock, with the precise transmission method involving multiple horizontal contacts. A good example is one Australian AI outbreak, whereby the only contact between the first infected premises and second farm site was an egg transport vehicle. The vehicle unloaded pallets containing egg fillers into the Production Area of one farm, and then loaded eggs from the Production Area of the second farm. | • Egg transport vehicles should have clearly demarcated contact zones in the Production Area (cool room/grading floor), which are disinfected by staff after collection.<br>• Vehicles and equipment should be disinfected after leaving.<br>• Ideally, the driver should use farm-specific footwear if entering into the cool room to retrieve trolleys or pallets of eggs, and wash and disinfect their hands before and after loading. |
| Vehicles: Feed delivery | Feed delivery vehicles will enter a Production Area, after having previously visited multiple farms that day. The farm silos are usually situated immediately adjacent to the sheds, which can contaminate the outside of the feed delivery vehicle with pathogen-laden dust. If not cleaned effectively, the vehicle can then transfer pathogens between sites. | By nature of their function, feed vehicles work in close proximity to the sheds that house the Flocks. They can become contaminated by dust leaving the shed, particularly in open-sided sheds on warm days or when the vehicle is parked adjacent the exhaust fans (common in mechanically-ventilated sheds). Blower feed delivery trucks can have a higher risk of contamination as they draw air from the immediate environment to pressurise the feed transport pods and push the feed into the silo. | • Feed delivery vehicles should be subjected to wheel wash, but at a minimum the driver should follow management instructions on clothing and footwear procedures.<br>• Commercial feed should be purchased from certified feed mills that have strict biosecurity compliance with truck washing between sites and trained, compliant drivers.<br>• Truck drivers should use gloves, or wash and disinfect hands prior to unloading and touching any farm equipment. Drivers should only move |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | | within the vicinity of the truck and silo and wear clean, protective footwear.<br>• Feed spills should be cleaned up immediately and the site must provide the necessary equipment to do so.<br>• Drivers should not be allowed entry to shed foyers, sheds, or come into direct contact with the Flock. |
| People movement: Visitors | People that come into the Production Area site who have been in direct contact with another farm, hatchery, processing plant or higher risk areas can carry pathogens on their hands, feet, clothing, in their hair, and even in their upper respiratory tract.<br>People returning from overseas can fall ill from, and carry, enteric pathogens, such as *Salmonella* Enteritidis. Visitors can also carry AI viruses on their clothes or footwear, which can be transferred to the stock directly or indirectly. | Pathogens are more likely to be transferred and infect a Flock if visitors enter the Production Area and have direct contact with the Flock.<br>If the Production Area is not clearly defined, visitors can may be able to enter the Production Area with ease, as this is where farm staff/management are likely situated. | • All visitors must meet the pre-visit quarantine restrictions before allowed entry to the Production Area.<br>• All visitors (including suppliers, production advisors and veterinarians) should be prevented from entering the Production Area when not necessary. Where entry is required, a pre-visit biosecurity check should be conducted that requests information regarding previous contact with high risk areas, such as other poultry farms, poultry processing plants, wetlands, aviaries, pet shops, livestock or overseas travel. Compliance should be provided in the form of a written declaration that is signed prior to entry, and this should include a record of last known contact with any key biosecurity risk. Visitors should be asked to wear clean clothing, a hairnet and mask if available (which may be provided by the manager). Depending on the perceived level of risk, it is preferable that visitors shower in on-farm amenities before putting on farm clothes and footwear, to prevent accidental pathogen transfer onto the Property.<br>• Visitors should not wear the same footwear and/or clothes to the Property if they have been worn to another farm or overseas. |
| People movement: Staff | Staff are the most frequent visitors to a Property and its Production Area.<br>Staff also move frequently between Flocks of different age, health status, and farming system (cage and free range), which increases the risk of pathogen transfer. | When staff are allowed to wear the same clothes and footwear from home to work, they represent a risk of transferring pathogens directly into the Production Area. | • Staff should be provided with work clothes specific to the Production Area upon arrival to work each day and leave them on-site upon exiting.<br>• Easy access to hand sanitisation and boot cleaning facilities should be available. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | | • Consider defining pathways of staff movement, which also states when they must change into dedicated clothing and footwear.<br>• Staff should have an employment contract with a clearly worded biosecurity clause advising their biosecurity requirements (e.g. they are not allowed to keep birds or poultry at home; they should not visit high-risk sites, such as wetlands, pet shops or other livestock prior to coming to work) and the consequences for not complying with this.<br>• Staff should be encouraged inform the manager of any uncertainties associated with biosecurity in the Production Area, or possible breaches of compliance to help explore ways of improving on-farm biosecurity.<br>• Security cameras can be installed at key entry points, and at hand wash/footwear change zones, especially grading floor entry points. |
| Egg belts and egg conveyors | Cloth egg belts and egg conveyors/anacondas represent high risk areas for pathogen retention and transfer (especially *Salmonella*). | Egg belts and conveyors/anacondas can be difficult to clean and can create a shed-to-shed transfer of pathogens on the Property. These need to be managed, especially where eggs can break, as egg yolk is a particularly good growth medium for bacteria such as *Salmonella*. | • Consider options for transferring eggs that minimise the risk of retaining pathogens, transferring pathogens between sheds, or improve opportunities for cleaning and disinfection. |
| Range area (free range flocks) | The range area is both a direct and indirect contact point with wild birds, vermin and rodents. This is a potential transmission route for high-risk pathogens (such as AI virus) to commercial poultry operations. There can also be contact between hens in adjacent sheds through the mesh fencing. It is not feasible to control faecal-oral endemic pathogens in the soil outside the range. | Range areas may attract aggregates of wild birds, particularly waterfowl that can transfer poultry pathogens. | • Control vegetative growth.<br>• An effective rodent control program and wild bird deterrent system should be used to prevent wild birds aggregating and rodents entering the range.<br>• Control of endemic disease will depend on ancillary tools like vaccination, feed additives and anthelmintic products.<br>• Spilt feed should be removed, and no feed (including scattered grain) should be provided on the range area.<br>• Open water (including pondage that can hold water after rainfall) should be avoided. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | | • There should be no permanent water bodies in the Production Area. |
| Equipment | Any equipment entering the Production Area can readily transfer pathogens into the Flock if it has been in contact with another farm prior to arrival and not cleaned and disinfected effectively. | Equipment can be difficult to effectively clean and disinfect due to odd shapes, vulnerable components and 'hard to reach' places. There may also be difficulty with electrical components that cannot be easily pressure-washed or cleaned. Examples include tools, trailers and smaller vehicles (such as bobcats and pallet jacks used for litter removal and egg handling, respectively). All equipment that enters the Production Area increases the risk of pathogen transfer. | • Management should inspect all equipment entering the Production Area and have procedures in place that allow assessment of historical movement, inspection of cleanliness, and disinfection procedures.<br>• Where possible, dedicated equipment to each Production Area should be supplied.<br>• High-use equipment should have routine cleaning and disinfection SOPs and staff should be trained in their application. Some items may not be washable and so disinfection by hand may be a better and more effective option. |
| Suppliers – other materials | Other materials, such as netting, wooden pallets and shavings, may need to enter the Production Area. These materials cannot be effectively decontaminated and increase the risk of pathogen transfer into the Production Area. | Materials from suppliers can be contaminated with pathogens, parasites and insects and are very difficult to clean, increasing the risk of transferring them to the Production Area. They may also be unloaded onto a contaminated surface that inadvertently transfers the pathogens back into the Production Area. | • Any materials that enter the Production Area should be subjected to an appropriate risk assessment prior to transfer.<br>• Options may include washdown and disinfection by liquid spray, tank dunking or fumigation in a chamber.<br>• Procurement of new and unused materials is preferred over second hand materials, particularly if sourced from another poultry farm.<br>• Consider other options for storage of the supplies on the Property, outside of the Production Area. |
| Waste disposal (manure/ dead birds) | Contractors who collect and transport farm waste can inadvertently transmit pathogens between sites.<br>Waste disposal and storage in the Production Area can attract wildlife (birds, rodents and vermin), which can introduce pathogens to the Production Area. | When waste is disposed of on-farm, vehicles, people and equipment passing between the farm and the disposal site can transmit pathogens from the disposal site back to the Production Area.<br>In one AI outbreak, it was highly suspected that the virus was transmitted from one infected premises to a second farm via dead birds that were collected by a waste vehicle that tipped the waste bin at the Property perimeter, which was closely adjacent the Production Area. | • Waste disposal in the Production Area should be avoided.<br>• Composting should be performed off-site and strict biosecurity controls maintained between the compost site and the Production Area.<br>• Waste disposal vehicles, trailers and other equipment should be effectively managed if they must enter the Production Area, including washing and disinfection before being allowed onto the site. Consider options that reduce the need for waste disposal vehicles to enter the Production Area. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | | • Use a dedicated/specialist vehicle for manure transfer. |
| Other waste disposal | Contact with skip-bin disposal has been associated with pathogen transfer between Properties. | All waste disposal creates a potential contact point with other Properties, both prior to and after collection from the Property. Waste disposal is therefore a key risk that must be managed. Examples of these wastes include non-organic (such as plastics, used fillers and pallets), and organic (such as reject eggs and spilt feed). | • Management should conduct a risk assessment of waste disposal, requirements and methods, and focus on contact points to ensure these do not lead to crossover with the Production Area.<br>• Consider situating the disposal outside of the Production Area perimeter fence, and ensure staff visit there at the end of the day immediately prior to leaving the site (they should not go back into the sheds after going to the skip bin). |
| Water bodies or surface water (e.g. dams, ponds, rivers and creeks) | Open water bodies in the Production Area will attract waterfowl and provide an environment for pathogen contamination and transfer. Waterfowl have been known to carry pathogens that can result in emergency and endemic disease outbreaks such as AI, and EDS, respectively. | Waterfowl tend to land on open waterways and may then venture toward the range area and sheds in the Production Area. Larger water bodies also attract larger numbers of waterfowl and encourage breeding, which increases the risk of pathogen transmission. | • It should be a high priority for any manager with an open water body in the Production Area to manage the risk that it poses to the Flocks.<br>• If large water bodies are present, they could be filled in and moved outside the Production Area or fenced off, so they are separate from the Production Area to restrict waterfowl movement toward sheds, or staff movement toward the water body.<br>• Avoid having water bodies in the Production Area, in free range farm range areas, or adjacent silos or shed entry areas and farm sheds.<br>• When practicable, use a deterrent system, such as sound, light or inflatable objects on any open water bodies, to reduce waterfowl congregating and environmental contamination of the Production Area.<br>• Production Area drainage should be adequate to limit standing water collecting in areas on the ground near sheds and on and around ranges. |
| Vegetation around sheds | Vegetation around sheds and in range areas needs to be managed as it can encourage wild birds and other wildlife into the Production Area, which increases the risk of contact and pathogen transmission. | Vegetation around sheds can also encourage wildlife, such as foxes and rodents, that can carry pathogens into the Production Area and create secondary losses due to smothers and secondary stress-related disease. | • Any trees in the range areas should be scattered with tighter foliage to reduce wild birds perching. Reducing vegetation immediately adjacent to the sheds also reduces fire risk during dry seasons, and the habitat for vermin. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| Domestic livestock | Domestic livestock can be infected with pathogens such as *Salmonella*. If allowed into the Production Area, their faeces can collect on wheels and/or footwear and be carried into sheds. | Domestic livestock allowed access to the Production Area tend to congregate around the sheds and walkways, soiling them with faeces. Soiled roadways and pedestrian access paths can result in people, vehicles and wild animals/rodents transferring pathogens onto the Production Area. | • Any on-site domestic livestock should be fenced off from roadways and pedestrian paths to prevent soiling them.<br>• Domestic livestock should not be permitted entry to the Production Area. |
| Feed spills | Feed spilled during unloading or system break-down will attract wild birds and wildlife, which can introduce pathogens to the Production Area and increase the risk of pathogen transfer into the sheds to the Flock. | Feed spillage is a common occurrence after feed delivery and should be managed appropriately to prevent encouragement of wild birds and wildlife into the Production Area. | • Any spilled feed or feed found around the silos and delivery area should be cleaned up immediately after delivery.<br>• Discourage wild birds and wildlife from gathering around silos, including the use of use of various deterrents to prevent perching and nesting, or design options that reduce opportunities for wild birds and animals to congregate. |
| Pests: Rodents and other vermin | Rodents, foxes, rabbits, cats, kangaroos, reptiles and even wild pigs can carry pathogens into the Production Area that can infect the Flock. | Rodents and other vermin are attracted to poultry farms as they provide a good source of food, shelter and warmth. | • Ensure adequate fencing is in place around the Production Area to minimise vermin movement and discourage them from venturing close to the sheds.<br>• Vegetation levels should be kept low, as rodents and other vermin will be discouraged by the exposure. |
| Pests: Wild birds | Wild birds can carry pathogens, parasites and external parasites, which can infect poultry. They represent a high risk of infection and increase the risk of pathogen transfer into the Production Area. | Wild birds can include waterfowl and non-waterfowl species. Wild birds do not usually enter sheds via pop-holes on free range farms, as they are more likely to fly into open barn doors at the end of the shed, or holes along the eaves of the shed or foyer doors (if left open). They should not be allowed to enter sheds and should also be prevented from entering shed foyer areas, packing/grading floor areas, and machinery/storage sheds in the Production Area. Waterfowl tend to land on water bodies and then walk across the ground toward the Production Area. | • The main shed doors should be kept closed at all times when stocked with poultry.<br>• Consider design options in the Production Area that prevent perching, feeding and nesting behaviours by wild birds.<br>• Spilled feed should be cleaned up immediately.<br>• Wild birds should be prevented from nesting, or removed from nesting under the eaves of sheds, in evaporative cool pad chambers, around silos, inside storage sheds, or on the packing floor.<br>• Water bodies that cannot be filled in or emptied should be managed to minimise wild bird presence, particularly waterfowl.<br>• Vegetation around sheds should be reduced. |
| Pests: Insects | Insects (such as flies) can transfer pathogens into the Production Area and infect the Flock. | Manure can provide an ideal breeding environment for insects, particularly in the summer months. Flies have | • Manure should not be allowed to excessively accumulate and should be managed in a way that |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | been shown to transmit both viral and bacterial pathogens over long distances. It is imperative that insects are managed as part of the farm's Biosecurity Management Plan. | minimises the breeding of flies and other insects.<br>• In deep litter sheds, in-feed insecticides that prevent larval development can be used to reduce population numbers.<br>• Insecticides and strips can be used in foyers and egg grading floors, and doorways can have plastic strips or air curtains to reduce insect entry.<br>• Effective cleaning of surfaces in foyers and grading floors will reduce accumulation of waste that attracts flies and other insects. |

# 7 The Flock – biosecurity risk identification

## 7.1 Scope and overview

### 7.1.1 What is 'the Flock'?

*The Flock includes all poultry in the Production Area, regardless of age, housing or breed.*

Controlling biosecurity risks at the Flock level is the last line of defence against a pathogen infecting a Flock. Once an infectious agent enters the Production Area, it may transmit through the Flock (depending on the immune status of the Flock). Pathogens have evolved to transmit easily between birds, therefore, large numbers of hens on a farm will lead to a rapid transmission through the Flock.

### 7.1.2 What are 'Flock' biosecurity risks?

*Biosecurity risks at the Flock level are those that are posed by the transfer of pathogens between birds and by direct contact with people, rodents, wild animals and equipment, etc., which may be carrying pathogens that can infect the hens (and cause disease in the hens or humans).*

It is normal for layer operations to have multi-age sites. The Flock should be managed according to age and disease status with personnel, equipment and vehicle movement from youngest/healthiest to oldest/infected. The transmission rate will depend upon the nature of transmission, that is to say, faecal-oral transmission will spread faster in a floor-based shed compared to a cage shed, and respiratory infections will transmit faster in a cage shed with higher density and wind speed than a barn shed, and much faster than faecal-oral transmission. Contact transmission organisms spread slowest (e.g. red mites).

The Flock's susceptibility to disease agents can be significantly reduced by vaccination and husbandry management. Once the biosecurity risks have been identified at the Production Area level, the same risks must be also considered at the Flock level but expanded to consider risks associated with housing and type of production. Production Area and Flock level risks are closely related and should be managed simultaneously. For example, on a free range farm it may be difficult to stop wild birds flying over the range areas, or perching on the roof or in trees planted specifically in the range for cover, however, the manager can keep the grass low to maximise sunlight penetration to ground level, ensure there are no open water bodies in the range area or nearby to the Property perimeter that would attract waterfowl, and can have good perimeter fences and tidy shed areas with effective rodent control programs to make the site less attractive to wild birds and keep rodents numbers to a minimum. Following this, direct engagement of the risk to the Flock will be subsequently minimised.

Flock vaccination is a critical part of the Biosecurity Management Plan as it provides an immunity barrier that effectively increases the number of pathogen particles required to cause disease infection. It also slows the levels of pathogens shed by the poultry, and therefore decreases the risk of the pathogen spreading in the Flock. Vaccines can help to reduce the risk of the occurrence and spread of disease in layer flocks. Most of the vaccines available provide good disease control in layers in Australia. Care and planning must be taken when considering which vaccines should be used, and how they are administered, to ensure the vaccination program is as effective as possible. Other Flock treatments for health and pathogen control include medications such as anticoccidials, anthelmintics for internal parasites, and insecticides for external parasite control.

## 7.2 Biosecurity risk identification Section 3 – the Flock

**Table 3 Areas of risk identified in the Flock**

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| Shed entry process | The greatest risk of pathogen exposure to the Flock is when people and equipment enter the shed. | People can inadvertently carry pathogens on their clothing, hands, person or footwear.<br>Equipment and packaging can be contaminated with pathogens, which can infect the Flock either directly if it comes into contact with hens (e.g. catching frames, buckets, weigh cells), or indirectly if it comes into contact with something that ultimately comes into contact with the layers (e.g. feed conveyor). | • Approved shed entry procedures should be established by the farm manager and anyone entering a Flock should follow these requirements. They may include the use of foot baths, change of boots, change of clothes, hair nets, and washing and disinfection of hands, which all need to be facilitated by the manager (e.g. via provision of hand sanitation facilities).<br>• Any item taken into a shed should be assessed for cleanliness, and if it is not brand new, it should be washed and/or disinfected prior to entry.<br>• Each shed should have a clear entry that should be kept clean and tidy, and disinfected regularly.<br>• Shed-specific clothing and boots could be provided. |
| Chick boxes and trolleys | Chick boxes, trolleys and dollies may be contaminated from the hatchery or another farm and could transmit pathogens into the Flock during chick placement. | Contamination of trolley and dolly castors is inevitable during unloading.<br>Chick crates can come into contact with the inside of sheds, and in floor-based rearing it could mean they become soiled with litter.<br>Sometimes smaller deliveries and reloading of creates can be made to multiple farms by the one vehicle, which is a potential for contamination of the remaining chicks. | • The manager should request evidence that the hatchery vehicle has not been to any other farm prior to chick delivery and that all crates and trolleys were effectively washed and disinfected prior to delivery.<br>• Delivery equipment should be inspected by the manager before unloading is permitted.<br>• Consider tipping chicks from an open doorway or transfer chicks into on-farm crates before taking them into the shed, rather than taking hatchery trolleys and crates into the shed. |
| Chick health: Vertical transmission | Day-old chicks can carry pathogens passed on from the source breeder flock or hatchery, which can infect the rest of the Flock. | Some pathogens are vertically transmitted (i.e. from the parent to the chick during development in the egg) from the breeder flock, such as Mycoplasma and Egg Drop Syndrome. Some pathogens are transmitted on the surface of eggs during incubation and transfer to the chicks on hatching. | • The manager should obtain a record of the vaccination history of their Flock, which should be sourced from a reputable supplier that has documented high biosecurity procedures in place for their breeders and hatchery operations. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| Vehicles: Pullet placement/ transfer | Transport cages and vehicles cycle between farms and represent a risk for pathogen transfer if not cleaned effectively, as they have direct contact with the Flock. | Pullet movement is often carried out by contractors. Vehicles and equipment are moved between multiple rearing and production farms, carrying hens with differing health status. The trolleys can then be taken into sheds that also have a different health status (e.g. a fully cleaned out single-aged shed versus a multi-age shed). | • The manager should request evidence that the pullet transport vehicles and trolleys have been cleaned effectively prior to visiting any rearing farm, and have only travelled directly from rearing to production.<br>• When movement occurs within an enterprise, transport trolleys and modules should be cleaned effectively and stored securely between moves.<br>• Obtain pullet vaccination history prior to transport to farm. |
| Vehicles: Depopulation | Modules and crates used to transport spent layers to the processing plant can carry pathogens into the shed and infect the Flock, which is a higher risk in multi-age sheds where not all the hens will be removed. | Spent layer hens are most likely to carry pathogens that could be transferred during depopulation. Equipment and staff used to transfer these hens to slaughter can become contaminated. | • Equipment used for depopulation should be cleaned and disinfected effectively to eliminate transmission between Flocks and farms.<br>• The manager should request evidence from the contractors involved in depopulation that they comply with the personnel entry restrictions.<br>• Consider on-farm euthanasia as an alternative to sending hens for processing, to avoid contact with processing plants (especially on multi-age farms).<br>• Where hens are being transported to a processing plant, the transport company should have module, crate and vehicle cleaning and disinfection procedures in place; complete a cleaning and disinfection record that is presented to the farm owner prior to being allowed entry; and the vehicle and trolleys should be inspected by farm management. |
| Horizontal contact transfer from other Flocks (e.g. multi-age sheds) | Any Flock on a multi-age farm has a high risk of infection and pathogen transmission to other Flocks on the farm. Older layers have a higher chance of carrying pathogens and transmitting these to younger hens when introduced to the shed. | The risk of pathogen retention in multi-age sheds is considered substantially higher than single-aged sheds. Where hens are maintained in the sheds on an ongoing basis it is difficult to effectively clean the sheds, which retain pathogens, creating a unique environment where multiple pathogens could be present in a single shed.<br>When pullets are placed into a multi-age shed they are exposed to endemic pathogens soon after placement. This is a period of high physiological stress, as the Flock comes into lay and birds need to keep gaining body weight for consistent production of eggs and | • When possible, consider options for single-age sheds. Single-age Flocks on a Property is considered to provide greater risk management of pathogen transfer between Flocks.<br>• Consider all risks associated with moving people and equipment between sheds, to reduce the risk of transferring pathogens between an infected Flock and an uninfected Flock. This may include footbaths, hand sanitation or shed-specific clothing and boots. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | maintenance of shell quality. The impact of the pathogen infection cycle can therefore be worse in multi-age sheds compared to single age sheds. | • Determine what the appropriate vaccination and health management program is for Flocks on the Property through consultation with a veterinarian, which would include knowledge of disease risks in the region.<br>• A manager may need to consider completely destocking the Flocks to remove a pathogen from the Property. |
| People movement: Staff | Personnel can carry pathogens on their clothing, hands, hair, shoes and even in their nostrils, which can infect a Flock. | Staff are often required to work between multiple sheds on a site, or even between multiple farm sites on a single day, e.g. rearing and production units or free range and cage production units. Time constraints on farm staff may result in shortcuts being taken, coupled with the difficulty of sourcing high quality farm staff in rural areas. | • Management should develop people-movement controls and flock entry procedures/restrictions that account for the higher risks of older hens and infected Flocks. For example, a management option could be to only move from young Flocks to older Flocks. |
| People movement: Visitors and contractors who visit other farms | Contractor teams move between farms and they can carry pathogens on their clothing, footwear, person, vehicles and equipment. | Working between multiple farms on a single, or consecutive days, increases the risk of pathogen transfer. Often personnel in vaccination crews and depopulation crews do not have vast knowledge of biosecurity or pathogen transfer.<br>Equipment used by contractors may be used on multiple farms or between Flocks, without adequate cleaning and disinfection, which has been the cause of disease outbreaks on several farms. | • Management should ensure all visitors to the site meet the biosecurity requirements of that Property.<br>• Visitors should not wear footwear and/or clothing that has been to another farm or overseas.<br>• A pre-visit discussion and scheduling by the manager should ensure these conditions are met for all contractors and visitors who move between Properties or Flocks.<br>• Visitors should be advised not to visit pet shops, other farms, or areas where waterfowl frequent prior to visiting the Property.<br>• Management could request that all contractors and visitors sign a declaration that they do not have birds at their personal residence and have met the pre-visit contact restrictions, e.g. contact with other farms (or diseased farms).<br>• The manager could request evidence that the equipment used by contractors has been cleaned and/or sanitised prior to being brought into contact with the Flock (this could include cleaning options on the Property itself). |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | | • Visitors entering the Production Area must have appropriate footwear, clothing, and preferably a hair net, plus thoroughly washed hands. |
| Range area for free range Flocks | The outside of the shed is not a controlled space, so layers with access to a range can come in contact with wild birds, vermin, and external parasites, both directly and indirectly, which increases the risk of pathogen transfer to the Flock. | The range area can be attractive for wild birds, vermin (rodents and wildlife) and insects. These animals can travel large distances and carry pathogens that could infect the Flock either directly if they inhabit the range, or indirectly if they pass faeces in the range. | • Ensure range areas are well fenced to prevent larger vermin species from entering, the grass is kept low, there are no open bodies of water or larger holes that can hold water after rainfall, and there are no wastes left that could attract insects or vermin.<br>• Horizontal structures in the range, such as artificial shade, will encourage the Flock out onto the Production Area and minimise contact with wild birds.<br>• It may be possible to cover the range to prevent contact with vermin and wild birds. |
| Pest control: rodents | Rodents will live and breed within poultry sheds, which increases the risk of pathogen transfer between batches, Flocks or sheds. | Rodents feed on eggs, dead hens, poultry feed and other shed wastes, so they can become infected with pathogens (such as *Salmonella*) and transfer disease between Flocks after depopulation/re-stocking, or between sheds. Research conducted in the United States on *Salmonella* has demonstrated that rodents are the primary source of *Salmonella* on commercial poultry farms. Although *Salmonella* are asymptomatic in layer hens, they are a food safety risk through internal contamination of the egg. | • A rodent control program should be considered a high priority to manage pathogen risks at the Flock level.<br>• Rodent control programs could be managed by a contractor that specialises in rodent control.<br>• Rodent control programs should be documented, including the location of bait stations, monitoring and recording of activity levels.<br>• Rodent control programs should not be located where hens can access the baits.<br>• It is possible that rodent control programs will need to be adjusted seasonally. |
| Pest control: flies and external parasites | External parasites, such as red mites, can dwell inside nest boxes, cages, and even the shed walls and floors, leading to reinfestation of subsequent Flocks. Litter beetles can also live inside the litter of floor-based sheds (free range and rearing) and inside the walls of the sheds, which can pass pathogens between batches within the one shed. | Mites are considered a pest, particularly red mites, lice and northern fowl mites, which may consume blood from chickens making them anaemic, causing skin irritation, and reducing productivity.<br>Litter beetles have been shown to carry many different bacterial and viral diseases, and are a source of pathogen transmission between Flocks and sheds on a Property. Diseases include *Salmonella*, *Campylobacter* and other avian pathogens. | • Once a Flock becomes infected, shed cleanout procedures will require additional cleaning to expose all potential sites where mites may hide, to ensure contact between the pests and the insecticides.<br>• Litter beetles can be controlled with effective insecticide sprays following removal of all litter and shed furnishings. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | | • Some sheds may require improved sealing of wall panels and fumigation of the shed to effectively treat inaccessible places. |
| Ineffective cleaning of internal shed equipment (e.g. cages, feeders, drinkers, egg belts and furnishings) | Transfer of pathogens between Flocks and batches. | High bacterial loads, including *Salmonella* and some viruses, can remain on equipment that was in contact with the previous Flock of layers. | • All cages, feeders and internal cage furnishings, such as supplementary drinker fonts, air intake pads and vents, floor slats and supplementary feeders, should be cleaned and disinfected.<br>• Drinker lines should be flushed (with water or other treatment) to remove any residual pathogens and biofilm. |
| Shed cleaning and disinfection | Inadequate shed cleaning and disinfection between Flocks increases the risk of pathogen transfer to the new Flock, and sets the general culture of biosecurity on that Property at a lower standard than other poultry production units. | Effective shed cleaning and disinfection is an essential part of removing pathogens, rodents, insects and other organics that can be transferred to the new flock and increase risk of disease exposure. This is limited capacity for effective shed cleaning and disinfection in multi-age sheds. | • Farm management should conduct a risk assessment on shed cleaning and disinfection to maximise the reduction of pathogens, parasites and insects at shed turnaround. This ensures that each new Flock has a low pathogen burden and is given the best chance of high performance. This will be impacted by the type and age of the sheds themselves. |
| Drinking water | Untreated drinking water from surface water or rain water capture represents a high biosecurity risk when it is supplied directly to the Flock. Any pathogens present in the water can infect the Flock, and serious pathogens, like AI, are readily transmitted via contaminated drinking water. | Poor quality drinking water is an ideal medium for pathogen survival. If contamination is resultant of the source (e.g. surface water from a dam or river), or during storage (e.g. open tank), then the pathogens can survive through the system and infect the Flock. Endemic pathogens, like EDS, can transmit from waterfowl through contaminated drinking water, and cause egg production drop and shell quality problems. EADs can also be transferred through water used for drinking or cooling. | • Where surface water is used, it should be filtered to reduce organic load prior to sanitisation. Options include: sand filtration followed by chlorination to achieve 3-5ppm available chlorine; the use of chlorine dioxide; and the use of UV light (although UV has limitations).<br>• Ideally, water should be stored in a sealed tank after treatment to prevent it becoming re-contaminated.<br>• Treatment should be tested regularly to assess efficacy.<br>• Water tanks used for drinking and/or cooling must be fully covered to prevent unwanted organic material access. This includes sealing of the inlet, not just the use of mesh cover that is supplied with the tank. |
| Feed | Feed represents a high biosecurity risk, as it can harbour pathogens and is supplied directly to the Flock. | Raw materials represent a high risk of pathogen entry to the Flock, especially *Salmonella*. | • The manager should consider all options to ensure the quality of raw materials, including documentation of manufacturing and storage of feed and feed ingredients. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | Contamination of feed ingredients or spoiling of finished feed can occur if not stored correctly.<br>Mash feed is a higher risk than pelleted/crumbles, as there is no heating process during manufacture that can remove enteric organisms. | • Treatment options may be viable for high risk ingredients.<br>• Feed can be purchased from a specialist company accredited to FeedSafe (QA scheme).<br>• Consider using additives to alter the pH of the feed and/or gut, such as organic acids and medium-chain fatty acids.<br>• Consider using crumbles (crushed pellets) rather than mash feed for starter rations. |
| Cooling system | Cool cell pads can be difficult to treat effectively between and within batches, which can be a source of pathogens to the Flock.<br>The water used for cooling can carry pathogens and infect the Flock if untreated prior to reticulation. | Cellulose pads are generally 150mm thick and have angled channels that make cleaning and disinfecting very difficult. They can retain dust that contains pathogens and can infect Flocks.<br>The water reticulated over the cool cell pads can be contaminated with pathogens, which can be drawn into the shed and infect the Flock. | • Cool cell pads should be a priority for treatment during shed cleanout.<br>• Water used for cooling should be treated prior to supply to the cooling reservoir system, or at least disinfectant capsules (Bromide) should be added to the cooling reservoir to maintain disinfection concentrations during operation. |
| Dirt floors | Pathogens can survive in dirt floors, shed walls, and even the range area outside free range sheds. | Certain pathogens associated with free range Flocks include fowl cholera, coccidiosis and spotty liver. These pathogens can survive in the litter and earth floors, both inside and outside the shed, and infect new Flocks after placement.<br>Birds can dig in range areas and leave pits that can retain water after rainfall and are difficult to clean. | • It is not feasible to remove all pathogens from dirt floors and the range areas with varied treatments, so greater emphasis may be put on vaccination, feed additives and other forms of control at the Flock level.<br>• Synthetic mesh outside the pop holes in range areas can reduce erosion and direct contact with dirt in high traffic areas. |
| Dead hen collection and storage | Dead hens may contain pathogens that can be transferred to the Flock. The people and equipment used to collect dead hens can also become contaminated with pathogens. | Collection, removal, transport, storage and disposal of dead hens is a key focus point for managing biosecurity and preventing transfer to the Flock on poultry farms. | • The buckets used to collect and transport dead hens should be disinfected before and after use. Separate collection buckets for each shed could be used.<br>• Mortalities should be removed from the shed and transported to a storage/disposal site at least daily, and more frequently if there is elevated mortality in a shed.<br>• Staff who have handled mortalities should wash their hands thoroughly and if there has been elevated mortality in a shed, advise management before moving to any other Flocks on the Property. |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | | • On-farm storage of dead hens should be contained to prevent rodent and wild bird access.<br>• Composting and freezing of dead hens can be highly effective for limiting pathogen transfer. |
| Dead hen disposal | Dead hens are a source of pathogens and should be removed from the Flock regularly. Contact with on-site and off-site disposal systems is also a primary source of pathogen transfer and should be managed appropriately. | Contractors who collect and transport farm waste can inadvertently transmit pathogens between sites, which can increase the risk of transfer to Flocks.<br>When on-farm waste disposal is used, the vehicles, people and equipment passing between the farm and the disposal site can transmit pathogens to the Flock if effective biosecurity procedures are not followed. | • The disposal system should be customised for each operation and procedure used for dead hen removal, transport and storage, which must be outlined in the Farm Biosecurity Plan.<br>• Staff should be trained in the disposal procedures and provide documentation to prove that these procedures have been followed.<br>• There should be complete separation of dead hens between sheds on the farm to prevent transmission of pathogens. |
| Waste disposal: manure removal | Contact between manure collection systems and disposal outlets via people, vehicles and machinery can cause pathogen transfer to the Flock. | Litter can be contaminated with faeces that carry pathogens (respiratory and enteric), which can infect other Flocks through contact with disposal vehicles, equipment and personnel. | • Dedicated vehicles should be used for manure removal and transport.<br>• Back-loaded grain trucks should not be used to carry manure or used litter.<br>• Staff involved in the process should be trained to prevent contact with manure and the Flock, which may include restricting access to the Flock after contamination.<br>• Vehicles and equipment used for manure removal should be cleaned and disinfected between use when possible. |
| Waste disposal: litter removal | Used litter can carry enteric pathogens, such as bacteria (*Salmonella* and Spotty Liver), viruses, parasites (coccidiosis and worms) and insects (flies, litter beetles and larvae). | Litter disposal is a high-risk biosecurity practice as it is a primary form of pathogen transfer. If litter is not completely removed prior to shed disinfection, the people and equipment involved can transfer pathogens to other Flocks on the Property. | • People allocated to litter removal should be trained in appropriate biosecurity procedures to ensure the effective disinfection of all equipment used, and to prevent contact with other Flocks.<br>• After removing litter, the walls and hard-to-reach areas should be swept to maximise the effectiveness of litter removal and prevent cross-contamination of the next Flock placed into the shed.<br>• Used litter should not be stockpiled in the Production Area or on the Property, unless |

| Area of risk identified | Why is there a risk? | Features of the risk | Options to control the risk (not for public release) |
|---|---|---|---|
| | | | alternative risk management options are in place (e.g. composting) and permit conditions allow it. |
| Nest box management and cleaning | Nest boxes and pads have direct contact with the layers and can be a source of pathogen transfer, especially *Salmonella*. If they are not kept clean, nest boxes can also harbour parasites, such as mites. | Effective cleaning of nest boxes and nest pads is imperative between batches to ensure no pathogens and parasites are transferred to new Flocks. | • Effective cleaning and disinfection with chemicals and insecticides should be practised, to reduce the transfer of infection between Flocks. |
| Choice of disinfectant | The correct disinfectant types must be used to control high-risk pathogens. | The use of an incorrect disinfectant can result in inadequate removal of pathogens from the shed and equipment inside the shed, which can result in the transfer of pathogens between Flocks. This is particularly important if a diseased Flock has just been removed from the shed. | • Selection of disinfectants should be made in conjunction with technical advice from the chemical supply companies.<br>• Farm management should conduct a risk assessment of their terminal shed hygiene program to ensure they are using the correct chemical range, concentration, application rates and order of application to maximise effectiveness against all target pathogens.<br>• Consider post-cleaning assessments that may inform the adequacy of the disinfectants selected. |
| Disinfection use | Application rates, volumes applied, and order of application can impact on the effectiveness of disinfectants. | Product use, including dilution, application rates, and combinations of products, can be ineffective if not conducted in accordance with the manufacturer's recommendations. | • Use of disinfectants should be made in conjunction with technical advice from the chemical supply companies.<br>• Farm management should conduct a risk assessment of their terminal shed hygiene program to ensure they are using the correct chemical types, concentration, application rates and order of application, to maximise effectiveness against all target pathogens. |
| Investigating Flock mortality or drops in production | Elevated mortality, clinical signs in birds, reduced egg production, or reduced shell quality are all signs that there could be an infectious disease in the Flock. | Delays in investigating Flock health issues can lead to rapid escalation and transfer to other Flocks on the Property, or even other farms in the area, which amplifies the biosecurity risk. Clinical signs, such as respiratory or enteric disease, mortality, low egg production or quality problems should be investigated promptly by management and an experienced avian veterinarian.<br>Clinical signs of disease can indicate that there is a problem in the Flock, which will make the primary management goal to contain the problem to the affected shed and prevent further transmission. | • Practices should be in place that support and encourage staff to notify management of any suspected health problems in the Flock.<br>• Staff should be trained to recognise normality from abnormality and respond to nonstandard changes in production.<br>• Considerations should be in place for varied management options in the case of a disease confirmation in a Flock, which may include restrictions on staff and equipment movement. |

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